Korean Chemical Society
Division of Organic Chemistry

제 41 회 유기화학분과회 심포지엄 및 정기총회

- 일시: 2022 년 2 월 17 일 (목)
- 장소: 온라인 회의 (ZOOM 미팅)
- 주관: 대한화학회 유기화학 분과회
- 공식후원업체: ㈜세진씨아이

제 41 회 유기화학분과회 심포지엄 및 정기총회

[프로그램]

10:20-10:30 **인사말** (김종승 대한화학회 유기화학분과회 회장, 고려대)

Session I <좌장: 박성준 (KRICT)>

10:30-11:00 임환정 (KRICT 정보융합신약연구센터)
One-Pot Synthesis, Structural Assignment, and Biological Studies of 4-Quinolones

11:00-11:30 전홍준 (KRICT 정보융합신약연구센터)
Rearrangement Reactions in the Total Synthesis of Cephalotaxus Alkaloids

11:30-12:00 방은경 (KIST 뇌과학창의연구단)
Delivery & Stabilization Technology of RNAs for Vaccines

12:00-13:30 점심/Lunch Break

Session II <좌장: 배한용 (성균관대)>

13:30-14:00 양정운 (성균관대 에너지과학과)
The Organic Approach to Asymmetric Catalysis

14:00-14:30 김성곤 (경기대 화학과)
Asymmetric Organocatalytic Reactions for the Synthesis of Fused Heterocyclic Compounds

14:30-15:00 장혜영 (아주대 화학과)
Green Catalysis: from Organocatalysis to Sustainable Catalysis

15:00-15:20 휴식/Break

Session III <좌장: 김 민 (충북대)>

15:20-16:00 **유기화학학술상 수상 및 강연**
조동규 (인하대 화학과)
Meso-fused Carbaporphyrins

16:00-16:30 성시광 (KRICT 감염병치료제연구센터)
Divergent Synthesis of Post-Iboga Alkaloids by CN Bond Cleavage

16:30-17:00 송충의 (성균관대 화학과)
Odyssey Towards Perfect Catalysis

총회 <진행: 류도현 총무부회장 (성균관대)>

17:00-17:50 **2021 년도 경과보고, 공로패 및 감사패 증정, 신임 분과회장 선출**

Session I

[10:30~12:00]

좌장: 박성준 (KRICT)

임 환 정 (Hwan Jung LIM)

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Education

Ph.D. (2009)	Department of Chemistry, The Ohio State University, USA (Prof. T. V. RajanBabu)
M.Sc (1999)	Department of Chemistry, Korea University (Prof. Bong Young Chung & Dr. Youseung Kim)
B.Sc. (1996)	Department of Chemistry, Inha University

Position

2020 – Present	Director, Department of Drug Discovery, KRICT
2020 – 2020	Head, Data-Convergence Drug Discovery Research Center, KRICT
2011 – Present	Senior & Principal Scientist, Data Convergence Drug Discovery Research Center, KRICT
2010 – 2011	Post-doc., Chemical Biology Research Branch, National Institute on Drug Abuse (NIDA) / National Institute of Health (NIH), USA (Mentor, Dr. Kenner C. Rice)
1999 – 2004	Senior Researcher, Choong-Wae Pharmaceutical Co.

Representative Publications

1. .* “Structural assignment of the enol–keto tautomers of one-pot synthesized 4-hydroxyquinolines/4-quinolones “ Kang, O.-Y.; Park, S. J.; Ahn, H.; Chung, K. C. and **Lim, H. J. *** *Org. Chem. Front.* **2019**, 6, 183.

2.“Broadly Applicable Stereoselective Syntheses of Serrulatane, Amphilectane Diterpenes, and Their Diastereoisomeric Congeners Using Asymmetric Hydrovinylation for Absolute Stereochemical Control” Tenneti, S.; Biswas, S.; Cox, G. A.; Mans, D. J.; **Lim, H. J.**; RajanBabu, T. V. *J. Am. Chem. Soc.* **2018**, *140*, 9868.

3. “Regioselective Synthesis of 1,2- and 1,4-Dihydroquinolines by Palladium-Catalyzed Intramolecular N-Arylation” Park, K.-Y.; Lee, J.; Park, S. J.; Heo, J.-N.; **Lim, H. J.*** *Adv. Syn. Catal.* **2015**, *357*, 3917.

4. “5.33 Hydrovinylation Reactions in Organic Synthesis” RajanBabu, T. V.; Cox, A. G.; **Lim, H. J.**; Nomura, N.; Sharma, R. K.; Smith, C. R.; Zhang, A. *Comprehensive Organic Synthesis II*, **2014**.

5. “Highly Efficient Catalytic Dimerization of Styrenes via Cationic Pd(II)-Complexes” Choi, J. H.; Kwon, J. K.; RajanBabu, T. V.; **Lim, H. J.*** *Adv. Syn. Catal.* **2013**, 355, 3633.

6. “Probes for Narcotic Receptor Mediated Phenomena. 48” **Lim, H. J.**, Rothman, R. B., Deschamps, J. R., Jacobson, A. E., Rice, K. C. *Eur. J. Med. Chem.* **2013**, 335.

7. “Asymmetric Hydrovinylation of Vinylindoles” Liu, W.; **Lim, H. J.**; RajanBabu, T. V. *J. Am. Chem. Soc.* **2012**, *134*, 5496.

One-pot synthesis, structural assignment, and biological studies of 4-quinolones

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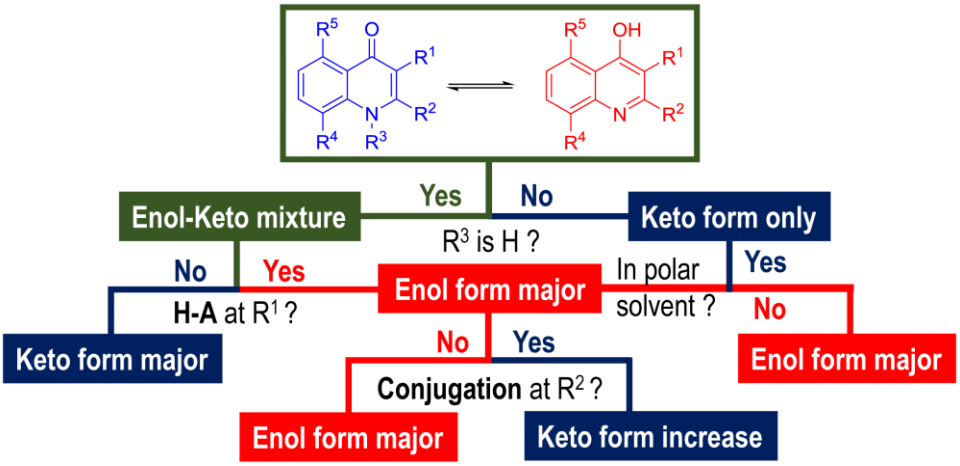
The one-pot preparation of 2,3-disubstituted 4-quinolones and the structural assignment of their tautomers are described. The mono-selective Michael addition of anilines to *α*,*α*-dioxoketene dithioacetals followed by thermal cyclization of the crude *N*,*S*-acetals gave the desired 4-quinolones in good to excellent yields.

The tautomeric structures of the obtained products were confirmed by X-ray crystallography, IR, and NMR experiments. Spectroscopic data revealed that the equilibrium between the enol and keto forms of the bicyclic system was determined by the strength of the internal H-bonds.

A H-bond acceptor at the 3-position favored the enol form *via* 6-membered intramolecular H-bonding. A H-bond acceptor at the 2- or 8-position completely switched the equilibrium to favor the keto form possibly due to extended conjugation and H-bonding. The experimental assignments were matched with the results of DFT calculation. The biological activities of the synthesized quinolones will be discussed during the presentation.



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Education

Ph.D. (2017)	College of Pharmacy, Seoul National University (Advisor: Sanghee Kim)
B.Sc. (2010)	College of Pharmacy, Seoul National University

Position

2020 – present	Senior researcher, Therapeutics and Biotechnology Division, Korea Research Institute of Chemical Technology (KRICT)
2020 – 2020	Post-doctoral fellow, Department of Chemistry, University of Pennsylvania (Advisor: J. Winkler)
2017 – 2019	Post-doctoral fellow, College of Pharmacy, Seoul National University (Advisor: Sanghee Kim)

Representative Publications

1. **Hongjun Jeon**, Sang Won Choi, Soojun Park, Seokwoo Lee,* and Sanghee Kim* Synthesis of Bridged Oxabicycles via Cascade Reactions Involving *O*-Acyloxocarbenium Ion Intermediates. *Org. Lett.* **2021**, 23, 8312–8316.

2. Jae Hyun Kim,[†] **Hongjun Jeon,**[†] Choyi Park, Soojun Park, and Sanghee Kim* Collective Asymmetric Total Synthesis of C-11 Oxygenated Cephalotaxus Alkaloids. *Angew. Chem. Int. Ed.* **2021**, *60*, 12060–12065 ([†] contributed equally)

3. **Hongjun Jeon**, Yundong Chung, and Sanghee Kim* Proline Ester Enolate-Claisen Rearrangement and Formal Total Synthesis of (–)-Cephalotaxine. *J. Org. Chem.* **2019**, *84*, 8080–8089.

4. **Hongjun Jeon**, Hyunkyung Cho, and Sanghee Kim* Total Synthesis and Structural Elucidation of (–)-Cephalezomine G. *Org. Lett.* **2019**, *21*, 1121–1124.

5. Somin Park, Jihee Cho, **Hongjun Jeon,*** Sang Hyun Sung, Seunghee Lee, and Sanghee Kim* Expedient Synthesis of Alphitolic Acid and its Naturally Occurring 2-O-Ester Derivatives. *J. Nat. Prod.* **2019**, *82*, 895–902.

6. **Hongjun Jeon**, Chaemin Lim, Ji Min Lee, and Sanghee Kim* Chemical assay-guided natural product isolation via solid-supported chemodosimetric fluorescent probe. *Chem. Sci.* **2015**, *6*, 2806–2811.

Rearrangement reactions in the total synthesis of *Cephalotaxus* alkaloids

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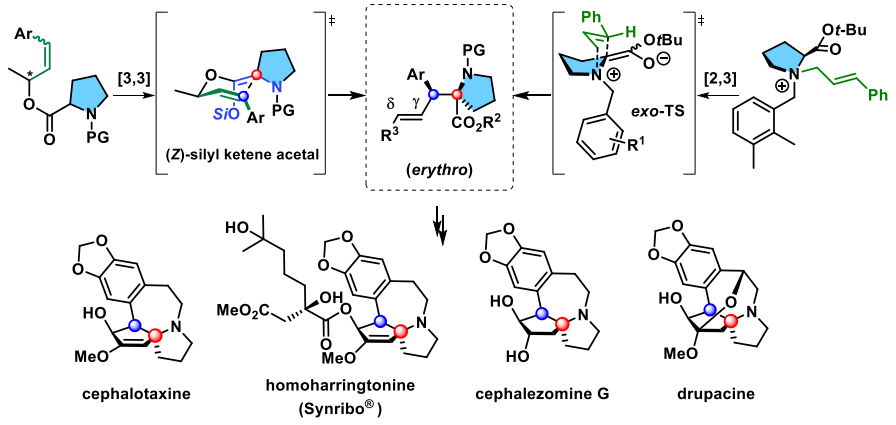
A rearrangement reaction is a broad class of organic reactions where a substituent moves from one atom to another atom in the same molecule to give a structural isomer of the original molecule. This reaction class has been widely employed to construct the skeleton of complex natural products. One of the representative and abundant skeleton of natural products is proline moieties, particularly Cα-substituted proline derivatives which have been recognized as very attractive substances due to their wide range of applicability in chemistry and biology.[1] A number of strategies for the asymmetric synthesis of Cα-substituted proline derivatives have been devised.[2] One of the promising and effective strategy would be [i,j]-sigmatropic rearrangement, from which enantioenriched proline derivatives are readily accessed by its well-defined transition state conformation. Using these rearrangements as key strategy, such as [3,3]-ester enolate–Claisen rearrangement and [2,3]-Stevens rearrangement, several *Cephalotaxus* alkaloids have been synthesized.[3,4] Notably, each rearrangement strategy has been applied to the total synthesis with the concept of a nonplanarity of *o*-substituted styrene moiety[4] and C to N to C chirality transfer,[3,5] respectively. In addition, the discovery of new type of rearragement reaction involving *O*-acyloxocarbenium intermediates (AOIs) during the total synthesis will be presented.[6]



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1. a) P. Maity, B. Kçnig, *Biopolymers* **2008**, *90*, 8–27; b) A. A. Morgan, E. Rubenstein, *PLoS One* **2013**, *8*, e53785.
2. For selected reviews, see: a) C. Cativiela, M. D. Diaz-de-Villegas, *Tetrahedron: Asymmetry* **2000**, *11*, 645–732; b) M. I. Calaza, C. Cativiela, *Eur. J. Org. Chem.* **2008**, 3427–3448.
3. Hongjun Jeon, Hyunkyung Cho, and Sanghee Kim* *Org. Lett.* **2019**, *21*, 1121–1124.
4. Hongjun Jeon, Yundong Chung, and Sanghee Kim* *J. Org. Chem.* **2019**, *84*, 8080–8089.
5. Hyunkyung Cho, Hongjun Jeon, Jae Eui Shin, Seokwoo Lee, Soojun Park, and Sanghee Kim* *Chem. Eur. J.* **2019**, *25*, 2447–2451.
6. Hongjun Jeon, Sang Won Choi, Soojun Park, Seokwoo Lee,* and Sanghee Kim* *Org. Lett.* **2021**, *23*, 8312–8316.

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Education

Ph.D. (2010)	Department of Chemistry, POSTECH (Prof. Byeong Hyeon Kim)
B.Sc. (2003)	Department of Chemistry, POSTECH

Position

2018 – present	Senior Researcher, Brain Science Institute, Korea Institute of Science and Technology
2014 – 2019	Presidential Post-doc. Fellowship, Brain Science Institute, Korea Institute of Science and Technology
2013 – 2014	Star Post-doc., Korea Institute of Science and Technology
2011 – 2013	Post-doc., Department of Organic Chemistry, University of Geneva (Prof. Stefan Maile)
2010.02 – 12	Post-doc., Department of Chemistry, POSTECH (Prof. Byeong Hyeon Kim)

Representative Publications

1. Park, H.-J.; Bang, E.-K.; Hong, J. J.; Lee, S.-M.; Ko, H. L.; Kwak, H. W.; Park, H.; Kang, K. W.; Kim, R.-H.; Ryu, S. R.; Kim, G.; Oh, H.; Kim, H.-J.; Lee, K.; Kim, M.; Kim, S. Y.; Kim, J.-O.; El-Baz, K.; Lee, H.; Song, M.; Jeong, D. G.; Keum, G.; Nam, J.-H. "Nanoformulated Single-stranded RNA-based Adjuvant with a Coordinative Amphiphile as an Effective Stabilizer to Induce a Humoral Immune Response by Activation of Antigen-presenting Cells", *Angew. Chem. Int. Ed*. **2020**, *29*, 11540.

2. Bang, E.-K.; Cho, H.; Jeon, S. S. H.; Tran, N. L.; Lim, D.-K.; Hur, W.; Sim, T. "Amphiphilic small peptides for delivery of plasmid DNAs and siRNAs", *Chem. Biol. Drug Design*, **2017**, *91*, 575-587.

3. Kim, J. B.; Lee, Y. M.; Ryu, J.; Lee, E.; Kim, W. J.; Keum, G. C.; Bang, E.-K. "Coordinative Amphiphiles as Tunable siRNA Transporters", *Bioconjugate Chem*. **2016**, *27*, 1850–1856.

4.Bang, E.-K.; Ward, S.; Gasparini, G.; Sakai, N.; Matile S. "Cell-penetrating poly(disulfide)s: focus on substrate-initiated co-polymerization", *Polymer Chem.* **2014**, *5*, 2433–2441.

5. Bang, E.-K.; Gasparini, G.; Molinard, G.; Roux, A.; Sakai, N.; Matile S. "Substrate-Initiated Synthesis of Cell-Penetrating Poly(disulfide)s", *J. Am. Chem. Soc*. **2013**, *135*, 2088–2091.

Delivery & Stabilization Technology of RNAs for Vaccines

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Vaccines prevent disease by injecting specific antigens into the body and inducing production of antibodies to the antigens. Vaccines can be classified according to the type of antigen to be injected. The viral vector vaccine and mRNA vaccine, currently supplied as a COVID-19 vaccine, transfer the gene of antigens to the human body, allowing the human body to produce the antigen. Genetic vaccines have the advantage of fast production if only the antigen is specified when there is a platform. These advantages were prominent in the development of the COVID-19 vaccine, and Moderna, the first company to enter clinical trials, entered phase 1 clinical trials only 69 days after outbreak, and it takes less than 10 months for mRNA vaccines to be approved for emergency use by the FDA.

Although the concept of mRNA vaccine was already proposed in 1980s it did not develop significantly due to its low stability and delivery efficiency. Before the COVID-19 pandemic came, clinical trials were already underway with mRNA vaccines against various carcinomas, Zika, influenza, CMV, and etc. There were various materials, such as protamine, dendrimer, and polymer, used to improve the stability and delivery of mRNA, but among them, lipid nanoparticle (LNP) was already approved as a formulation for a new siRNA drug (Onpattro®, Alnylam) in 2018, so it was quickly applied to the COVID-19 mRNA vaccine. The LNP formulation of the currently approved mRNA vaccine is not significantly different from that of Onpattro®, and these delivery technologies are all based on the same patent.

Based on my experience of delivery technique for siRNA delivery using various method such as direct modification, conjugation, cationic lipid, and cationic polymer, my current research is related to LNP-based mRNA vaccine delivery. In this lecture, I would like to briefly review the LNP used in mRNA vaccine and briefly introduce the coordinative amphiphile reported as a stabilizer for a ssRNA adjuvant.

References

1. Park, H.-J.; Bang, E.-K.; Hong, J. J.; Lee, S.-M.; Ko, H. L.; Kwak, H. W.; Park, H.; Kang, K. W.; Kim, R.-H.; Ryu, S. R.; Kim, G.; Oh, H.; Kim, H.-J.; Lee, K.; Kim, M.; Kim, S. Y.; Kim, J.-O.; El-Baz, K.; Lee, H.; Song, M.; Jeong, D. G.; Keum, G.; Nam, J.-H. “Nanoformulated Single-stranded RNA-based Adjuvant with a Coordinative Amphiphile as an Effective Stabilizer to Induce a Humoral Immune Response by Activation of Antigen-presenting Cells”, *Angew. Chem. Int. Ed*. **2020**, *29*, 11540.
2. Kim, J. B.; Lee, Y. M.; Ryu, J.; Lee, E.; Kim, W. J.; Keum, G. C.; Bang, E.-K. “Coordinative Amphiphiles as Tunable siRNA Transporters”, *Bioconjugate Chem.* **2016**, *27*, 1850.

Session II

[13:30~15:00]

좌장: 배한용 (성균관대)

양 정 운 (Jung Woon Yang)

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Education

Ph.D. (2003)	Division of Life Science, Korea Institute of Science and Technology (Dr. Choong Eui Song) & Department of Chemistry, Korea University (Prof. Hogyu Han)
B.Sc. (1995)	Department of Chemistry & Department of Journalism and Mass Communications, Hankuk University of Foreign Studies

Position

2009 – present	Assistant/Associate/Full Professor, Department of Energy Science, Sungkyunkwan University, Korea
2003 – 2009	Postdoctoral Research Associate/Senior Research Scientist/Group Leader, Division of Homogeneous Catalysis, Max-Planck-Institut für Kohlenforschung, Germany (Prof. Benjamin List)
1999 – 2003	Part-time Lecturer, Department of Chemistry, Korea University

Representative Publications

1. Byeon, H., Ryu, S., Yoo, E. J. and Yang, J. W.* "Substrate-Controlled Chemo-/Enantioselective Synthesis of α-Benzylated Enals and Chiral Cyclopropane-Fused 2-Chromanone Derivatives" *Adv. Synth. Catal.* **2021**, *363*, 5085.

2. Park, Y. J. and Yang, J. W.* "Glycerol Conversion to High-Value Chemicals: The Implication of Unnatural α-Amino Acids Syntheses using Natural Resources" *Green Chem.* **2019**, *21*, 2615.

3. Lee, T. W. and Yang, J. W.* "Transition-Metal-Free Conversion of Lignin Model Compounds to High-Value Aromatics: Scope and Chemoselectivity" *Green Chem.* **2018**, *20*, 3761.

4. Ding, A., Meazza, M., Guo, H.*, Yang, J. W.* and Rios, R.* "New Development in the Enantioselective Synthesis of Spiro Compounds" *Chem. Soc. Rev.* **2018**, *47*, 5946.

5. Yang, J. W., Chandler, C., Stadler, M., Kampen, D. and List, B.* "Proline-Catalyzed Mannich Reactions of Acetaldehyde" *Nature* **2008**, *452*, 453.

6. List, B.* and Yang, J. W. "The Organic Approach to Asymmetric Catalysis" *Science* **2006**, *313*, 1584.

The Organic Approach to Asymmetric Catalysis

Jung Woon Yang

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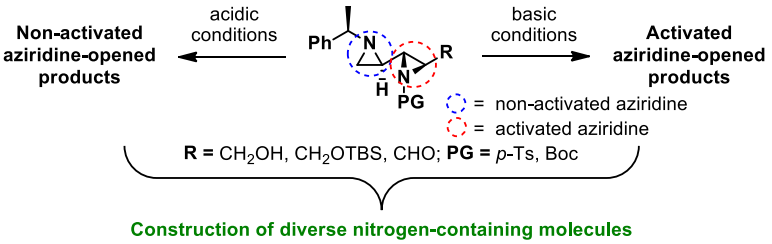
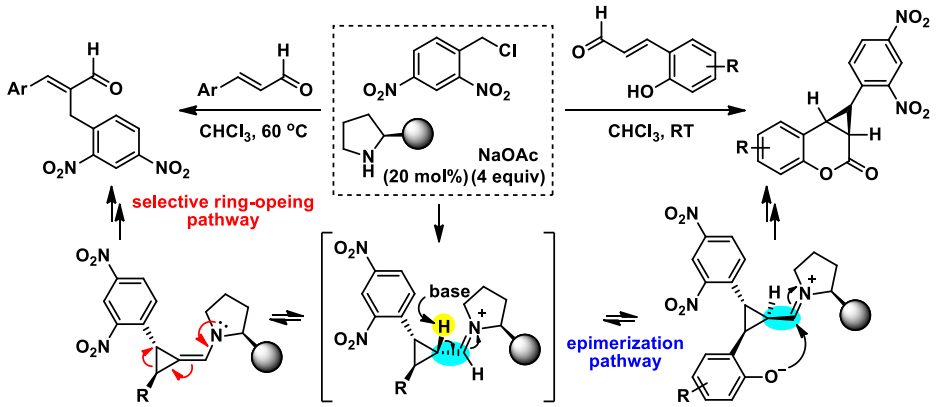
Over the last two decades, the research area of asymmetric organocatalysis has rapidly grown to become a third pillar in asymmetric catalysis, complementing enzymes and synthetic transition metal complexes.[1]

In this talk, I will present our recent two research topics on organocatalytic chemo-/enantioselective reactions for the construction of contiguous bisaziridines as chiral building blocks (Scheme 1)[2] and α-benzylated enals and chiral cyclopropane-fused 2-chromanone derivatives (Scheme 2)[3] utilizing iminium and enamine dual activations. The applications to biologically active molecules and the elucidation of reaction mechanism will be discussed.



Scheme 1. Synthesis and Utilization of Contiguous Bisaziridines



Scheme 2. Synthesis of α-Benzylated Enals and Chiral Cyclopropane-Fused 2-Chromanones

References

1. List, B.* and Yang, J. W. "The Organic Approach to Asymmetric Catalysis" *Science* **2006**, *313*, 1584
2. Rhee, H.-J., Ranjith, J., Byeon, H., Ha, H.-J.* and Yang, J. W.* "Preparation and Utilization of Contiguous Bisaziridines as Chiral Building Blocks" *Adv. Synth. Catal.* **2021**, *363*, 3250.
3. Byeon, H., Ryu, S., Yoo, E. J. and Yang, J. W.* "Substrate-Controlled Chemo-/Enantioselective Synthesis of α-Benzylated Enals and Chiral Cyclopropane-Fused 2-Chromanone Derivatives" *Adv. Synth. Catal*. **2021**, *363*, 5085.

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Education

Ph.D. (2000)	Department of Chemistry, POSTECH (Prof. Kyo Han Ahn)
Ph.D. (1997)	Department of Chemistry, POSTECH (Prof. Kyo Han Ahn)
B.Sc. (1995)	Department of Chemistry, Sogang University

Position

2008 – present	Professor, Department of Chemistry, Kyonggi University, Korea
2003 – 2008	Senior Researcher, KRICT, Korea
2001 – 2003	Post-doc., Department Chemistry, Caltech, USA (Prof. David W. C. MacMillan)

Representative Publications

1. Lee, C. Y.; Kwon, Y. I.; Jang, H. S.; Lee, S.; Chun, Y. L.; Jung, J.* and Kim, S.-G.* "Organocatalytic Enantioselective [4+3]-Cycloadditions of Azaoxyallyl Cations with 2-Aminophenyl Enones" *Adv. Synth. Catal.* **2021**, *363*, 4197.

2. Son, E. C.; Kim, S. Y. and Kim, S.-G.* "Squaramide-Catalyzed Asymmetric Intramolecular Oxa-Michael Reaction of α,β-Unsaturated Carbonyls Containing Benzyl Alcohol: Construction of Chiral 1-Substituted Phthalans" *J. Org. Chem.* **2021**, *86*, 6826.

3. Kim, E.; Lee, C. Y. and Kim, S.-G.* "Enantioselective Carbonyl 1,2- or 1,4-Addition Reactions of Nucleophilic Silyl and Diazo Compounds Catalyzed by the Chiral Oxazaborolidinium Ion" *Adv. Synth. Catal.* **2020**, *362*, 3594.

4. Son, E. C.; Lee, J. and Kim, S.-G.* "Base-Promoted Cycloaddition of γ-Hydroxy- and δ-Hydroxy-α,β-unsaturated Carbonyls with Azaoxyallyl Cations: Rapid Synthesis of *N*,*O*-Heterocycles" *Eur. J. Org. Chem.* **2020**, 3090.

5. Kwon, Y. I.; Choi, S.; Jang, H. S. and Kim, S.-G.* "Rapid Access to Hindered α-Amino Acid Derivatives and Benzodiazepin-3-ones from Aza-Oxyallyl Cations" *Org. Lett.* **2020**, *22*, 1420.

Asymmetric Organocatalytic Reactions for the Synthesis of Fused Heterocyclic Compounds

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Fused heterocyclic structural units including chroman, indoline, pyrrolidine and hydroqunoline are widely distributed in nature and many biologically active compounds. Molecules containing these structural units exhibit a broad range of bioactivities such as anticancer, antiviral, antitumar, antimicrobial, sex pheromone, and central nervous system activity. Owing to the importance of these class of compounds, the stereoselective synthesis of fused heterocyclic compounds is a noteworthy synthetic goal.

In this presentation, I will demonstrate the asymmetric synthesis of hydroquinoline, hydroquinazoline, and benzodiazepinones via cascade and cycloaddition asymmetric organocatalysis. Synthetic methods of fully substituted enantioenriched tetrahydroquinolines and 1,4-dihydroquinolines were developed using an organocatalytic aza-Michael/Michael cascade reaction. The asymmetric reaction of 2-(tosylamino)phenyl α,β-unsaturated ketones with alkynyl aldehydes, promoted by diphenylprolinol *O*-TMS ether as an organocatalyst, generated chiral 1,4-dihydroquinolines with excellent enantioselectivities. I will also present the asymmetric [4+3]-cycloaddition for the enantioenriched functionalized seven-membered benzodiazepinone using a chiral squaramide-based organocatalyst.

References

1. Lee, Y.; Heo. S. and Kim, S.-G.* "Asymmetric One-Pot Synthesis of 1,4-Dihydroquinolines via an Organocatalytic Aza-Michael/Michael Cascade Strategy" *Adv. Synth. Catal.* **2015**, *357*, 1545.
2. Kwon, Y. I.; Choi, S.; Jang, H. S. and Kim, S.-G.* "Rapid Access to Hindered α-Amino Acid Derivatives and Benzodiazepin-3-ones from Aza-Oxyallyl Cations" *Org. Lett.* **2020**, *22*, 1420.
3. Lee, C. Y.; Kwon, Y. I.; Jang, H. S.; Lee, S.; Chun, Y. L.; Jung, J.* and Kim, S.-G.* "Organocatalytic Enantioselective [4+3]-Cycloadditions of Azaoxyallyl Cations with 2-Aminophenyl Enones" *Adv. Synth. Catal.* **2021**, *363*, 4197.

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B.Sc. (1998)	Department of Chemistry, Seoul National University

Position

2006 – present	Professor, Department of Chemistry, Ajou University, Korea
2005 – 2006	Post-doc., Department of Chemistry, California Institute of Technology, USA (Prof. David W. C. MacMillan)

Representative Publications

1. Sung, K.; Lee, M.; Cheong, Y.-J.; Yu, S.; Jang, H.-Y.* "Ir(NHC)-Catalyzed Synthesis of β-alkylated alcohols via borrowing hydrogen strategy: influence of bimetallic structure" *Adv. Synth. Catal.*, **2021**, 363, 3090.

2. Seo, C.; Cheong, Y.-J.; Yoon, W.; Kim, J.; Shin, J.; Yun, H.; Kim, S.-J.; Jang, H.-Y.* "Mononuclear Copper Complexes with Tridentate Tris(N-Heterocyclic Carbene): Synthesis and Catalysis of Alkyne-Azide Cycloaddition" *Organometallics*, **2021**, 40, 16.

3. Cheong, Y.-J.; Sung, K.; Park, S.; Jung, J.; Jang, H.-Y.* ""Valorization of Chemical Wastes: Ir(biscarbene)-Catalyzed Transfer Hydrogenation of Inorganic Carbonates Using Glycerol" *ACS Sustainable Chem. Eng.*, **2020**, 8, 18, 6972.

4. Noh, H.-W.; An, Y.; Lee, S.; Jung, J.; Son S. U.; Jang, H.-Y.* Metal-free Carbon Monoxide(CO) Capture and Utilization: Formylation of Amines" *Adv. Synth. Catal.* **2019**, 361, 3068.

5. Sung, K.; Lee, M.; Cheong Y.-J.; Jang, H.-Y.* "Ir(triscarbene)-Catalyzed Sustainable Transfer Hydrogenation of Levulinic Acid to γ-Valerolactone" *Appl. Organomet Chem.*, **2020**, e6105.

Green Catalysis: from Organocatalysis to Sustainable Catalysis

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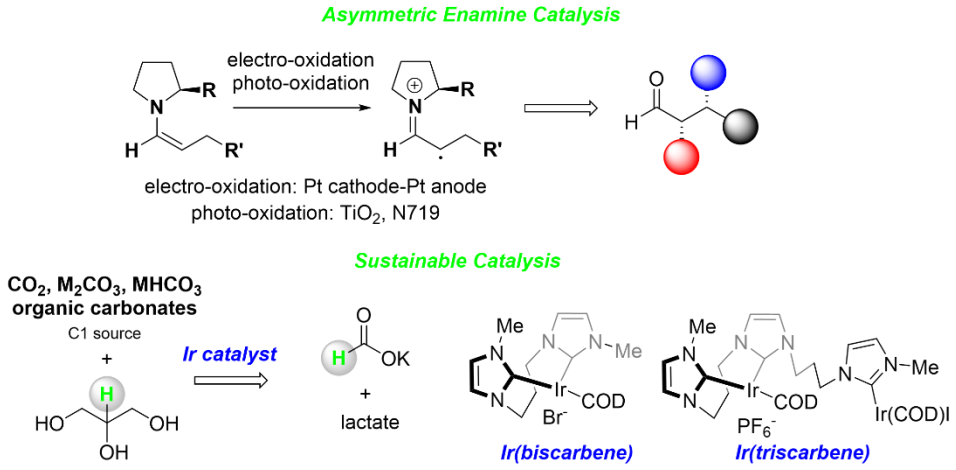
Green catalysis includes a wide range of catalytic reactions using less amount of toxic chemicals. For example, organocatalysis involves organic catalysts instead of transition metal complexes. In the case of photo- and electro-catalysis, stoichiometric amounts of chemical oxidants or reductants were avoided by employing light or electricity. Recent concerns on the global warming-induced by increased CO_2 concentration in the air expand the area of green catalysis to processes converting non-fossil fuel-based feedstock to value-added chemicals.

Our research group has been interested in environmentally benign chemical processes. Initial research focuses on the development of asymmetric enamine and iminium catalysis by merging electro-, photo-, and transition-metal catalyzed reactions. Current research interests are shifted to sustainable catalytic processes converting biomass and C1 gases (CO and CO_2). In this presentation, I would like to introduce our early research results related to "asymmetric organocatalysis" (the Nobel Prize in Chemistry 2021), and recent research results of iridium-catalyzed transfer hydrogenation of CO_2 in biomass-derived glycerol.



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Session III

[15:20~17:00]

좌장: 김 민 (충북대)

제 10 회 유기화학 학술상 수상자

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Education

Ph.D. (2008)	Department of Chemistry, The University of Texas at Austin (Prof. Jonathan L. Sessler)
M.S. (1994)	Department of Chemistry, Sungkyunkwan University (Prof. Suk-Ku Kang)
B.Sc. (1992)	Department of Chemistry, Sungkyunkwan University

Position

2009 – present	Professor, Department of Chemistry, Inha University, Korea
2008 – 2009	Research associate at The Scripps Research Institute, CA, USA (Prof. M. G. Finn)
1999 – 2003	LG Chem/LG Life Sciences Ltd.
1994 – 1999	Hanhyo Institute and Technology

Representative Publications

1. Hong, J.-H.; Aslam, A. S.; Cho, B.; Ko, M.-S.; Kim, Y.; Heo, J.; Cho, D.-G.* "Carbaporphyrin Dimers That Bear a Rigid Naphthalene Motif as an Internal Strap" *Org. Lett.* **2021**, *23*, 1846-1850.

2. Hong, J.-H.; Ko, M.-S.; Rao, P. S.; Cho, D.-G.* Systematic Modifications of a Simple Tolan: Another Category of Viscosity Sensor. *Org. Lett.* **2019**, *21*, 10085-10089

3. Hong, J.-H.; Aslam, A. S.; Ko, M.-S.; Choi, J.; Lee, Y.; Cho, D.-G*. "Bond Rotation in an Aromatic Carbaporphyrin: Allyliporphyrin" *Chem. Eur. J*. **2018**, *24*, 10054-10058.

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5. Hong, J.-H.; Aslam, A. S.; Ishida, M.; Mori, S.; Furuta, H.* Cho, D.-G.* "2-(Naphthalen-1-yl)thiophene as a New Motif for Porphyrinoids: Meso-Fused Carbaporphyrin" *J. Am. Chem. Soc.* **2016**, *138*, 4992-4995.

Meso-fused Carbaporphyrins

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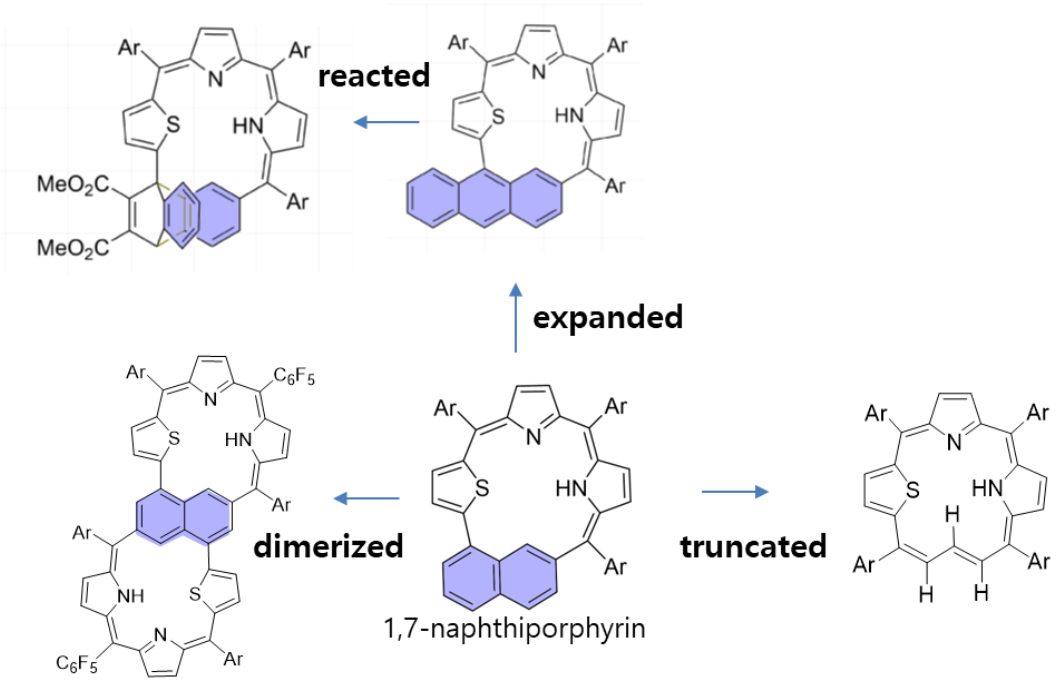
The synthesis of skeletally modified porphyrins has received much attention to yield novel properties, such as near infrared absorption, variable degrees of aromaticity, and unique metal coordination chemistry. Thus, a new category of porphyrinoids are highly demanded. Recently, our group has developed meso-fused carbaporphyrins including 1,7-naphthiporphyrin.[4] So far, four more carbaporphyrins[1-3] have been synthesized as its dimerized, truncated, expanded, and reacted forms of 1,7-naphthiporphyrin. Their syntheses and properties are discussed in detail.



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2. Hong, J.-H.; Aslam, A. S.; Ko, M.-S.; Choi, J.; Lee, Y.; Cho, D.-G*. "Bond Rotation in an Aromatic Carbaporphyrin: Allyliporphyrin" *Chem. Eur. J.* **2018**, *24*, 10054-10058.

3. Aslam, A. S.; Hong, J.-H.; Shin, J.-H.; Cho, D.-G.* "Synthesis of a Phlorin from a Meso-Fused Anthriporphyrin by a Diels-Alder Strategy" *Angew. Chem., Int. Ed.* **2017**, *56*, 16247-16251.

4. Hong, J.-H.; Aslam, A. S.; Ishida, M.; Mori, S.; Furuta, H. *; Cho, D.-G.* "2-(Naphthalen-1-yl)thiophene as a New Motif for Porphyrinoids: Meso-Fused Carbaporphyrin" *J. Am. Chem. Soc.* **2016**, *138*, 4992-4995.

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2019 – 2021	Post-doc, Department of Chemistry, KAIST (Prof. Sun Kyu Han)

Representative Publications

1. Lim, H.;† Seong, S.;† Kim, Y.; Seo, S.; Han, S.* "Biopatterned Reorganization of Alkaloids Enabled by Ring-Opening Functionalization of Tertiary Amines" *J. Am. Chem. Soc*. **2021**, *143*, 19966 (†These authors contributed equally).

2. Seong, S.; Lim, H.; Han, S.* "Synthesis of Types II and III Post-Iboga Alkaloids*" Strategies and Tactics in Organic Synthesis*; Harmata, M., Ed.; Elsevier; **2019**, *14*, chapter 2, pp 35-59.

3. Lim, H.; Seong, S.; Han, S.* "Syntheses of Post-Iboga Alkaloids" *Synthesis* **2019**, *51*, 2737.

4. Seong, S.;† Lim, H.;† Han, S.* "Biosynthetically Inspired Transformation of Iboga to Monomeric Post-Iboga Alkaloids" *Chem* **2019**, *5*, 353 (†These authors contributed equally).

Divergent Synthesis of Post-Iboga Alkaloids by C–N Bond Cleavage

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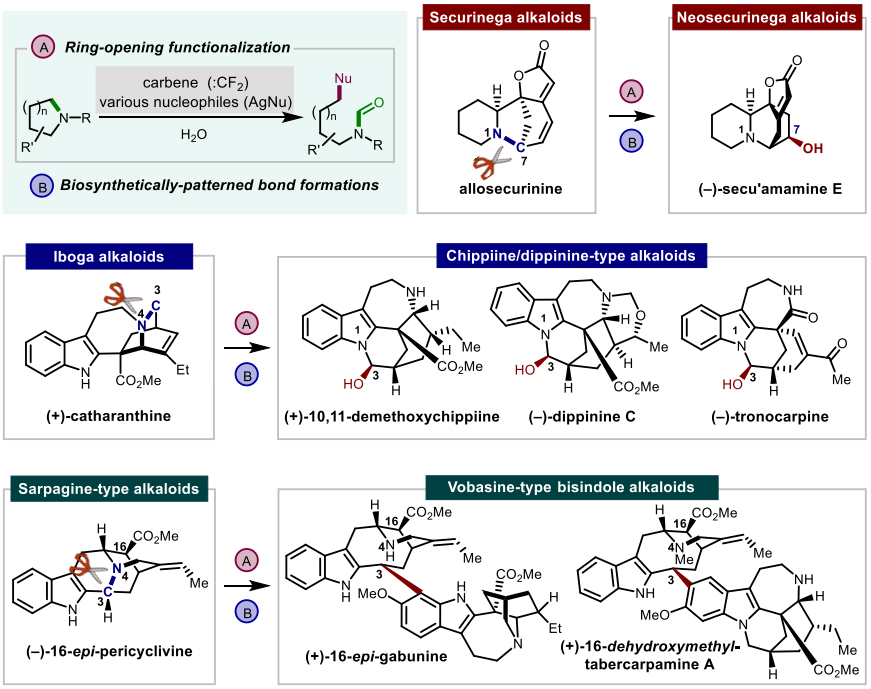
Iboga alkaloids are a large family of natural products that contain indole and isoquinuclidine moiety. We coined the term 'post-iboga' alkaloids for secondary metabolites that possess modified indole and/or isoquinuclidine frameworks which enabled us to categorize 5 types of post-iboga alkaloids based on their structural characteristics.

In this work, we show that deconstructive C–N functionalization of iboga scaffold facilitated divergent synthesis for post-iboga alkaloids. Furthermore, these types of C–N bond cleavage can be applied to securinega and sarpagine alkaloids.



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2. Seong, S.;† Lim, H.;† Han, S.* "Biosynthetically Inspired Transformation of Iboga to Monomeric Post-Iboga Alkaloids" *Chem* **2019**, *5*, 353 (†These authors contributed equally).

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Positions

2020-present	Moon-Haeng Chair Professor, Department of Chemistry, Sungkyunkwan University
2004-2020	Professor, Department of Chemistry, Sungkyunkwan University
1989-2003	Principal Research Scientist, Korea Institute of Science and Technology

Selected Recent Publications

1. Park, S. J.; Hwang,I.-S.; Chang,Y. J.; Song, C. E. “Bio-inspired Water-Driven Catalytic Enantioselective Protonation” *J. Am. Chem. Soc*. **2021**, *143*, 2552−2557.

2. Jadhav, A. P.; Park, S. Y.; Lee, J.-W.; Yan, H.; Song, C. E. “Cooperative Asymmetric Cation-Binding Catalysis” *Acc. Chem. Res*. **2021**, *54*, 4319−4333.

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Odyssey Towards Perfect Catalysis

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Through millions of years of evolution, nature has accomplished the development of the "ideal" catalysts called enzymes that catalyze the biological chemical reactions necessary to sustain all life on Earth. Lessons learned from how natural enzymatic systems operate can therefore provide new insights into designing the highly efficient and environmentally benign catalytic systems. In this talk, our recent biomimetic organocatalytic approaches[1-5] towards next-generation catalysis will be presented.

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5. Park, S. Y.; Lee, J. W.; Song, C. E. *Nature Commun.***2015**, *6*, 7512.

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