# Curriculum Vitae

## Laksmikanta Adak (*Ph.D. in Chemistry*)

International Research Center for Elements Science (IRCELS)
Institute for Chemical Research (ICR)
Kyoto University
Gokasho, Uji, Kyoto 611-0011, JAPAN

Phone: +81 774 38 3182
Mobile: +81 90 6669 6545
E-mail: ladak@scl.kyoto-u.ac.jp

## Personal details

Date of Birth: 25th September, 1981
Marital status: Married

Current Address: Feristas, Room No.-105
Gokasho, Uji, Kyoto 611-0011, JAPAN

## Professional experience

| Name of Institution | Location | Position | From–To |
|---|---|---|---|
| Kyoto University | Japan | Researcher | Sep. 1, 2014–Mar. 31, 2016 |
| Kyoto University | Japan | JSPS Postdoctoral Researcher | Sep. 1, 2012–Aug. 31, 2014 |
| Kyoto University | Japan | Researcher | Jun. 11, 2012–Aug. 31, 2012 |
| Nanyang Technological University | Singapore | Research Fellow | Jan. 18, 2010–May 21, 2012 |

## Educational details

| Name of University/Institution | Location | Degree | Field | Completion Year |
|---|---|---|---|---|
| Indian Association for the Cultivation of Science, Jadavpur University | Jadavpur, Kolkata, India | Doctorate (Ph.D.) | *Green Synthesis using Ionic Liquids and other Benign Metal Catalysts* | 09/11/2009 (submitted) 02/07/2010 (awarded) |
| Vidyasagar University | West Bengal, India | Master of Science (M.Sc.) | *Organic Chemistry* | 2005 |
| Midnapore College, Vidyasagar University | West Bengal, India | Bachelor of Science (B.Sc.) | *Chemistry Honours* | 2003 |
| Shyamsundarpur Patna High School | West Bengal, India | Higher Secondary Education (HS) | *Science* | 2000 |
| Gobindanagar Muslim High School | West Bengal, India | Secondary Education (MP) | *Science, Arts and Literature Subjects* | 1998 |

## Awards and achievements

1. **Awarded JSPS Postdoctoral Research Fellowship** from Japan Society for the Promotion of Science (Sep, 2012–Aug, 2014)

2. **Qualified National Eligibility Test (NET)**, Awarded Junior Research Fellowship (2005–2007) and Senior Research Fellowship (2007–2009) by the Council of Scientific and Industrial Research (CSIR), Govt. of India, New Delhi, India

3. **Awarded University Gold Medal** in B.Sc. (Chemistry Honours)

4. **Awarded National Scholarship** in B.Sc. study from Government of India, (2001–2003)

5. **Qualified Graduate Aptitude Test in Engineering (GATE-February' 2005)**; Percentile Score: **97.32**; All India Rank: **92**

## Participation in symposium/conferences

***Invited Presentations***

1. **Asian International Symposium-Coordination Chemistry, Organometallic Chemistry-**, March 26, 2016, Doshisha University, Japan
   Adak, L.; Jin, M.; Nakamura, M. invited presentation on "*Iron-Catalyzed Enantioselective Cross-Coupling Reactions of Racemic a-Haloesters"*

2. **8th CaRLa Winter School**, 07–13 March 2015, Heidelberg, Germany
   Adak, L.; Jin, M.; Nakamura, M. invited presentation on "*Iron-Catalyzed Enantioselective Cross-Coupling Reactions of Racemic α-Haloesters*"

3. **4th J-NOST Conference for Research Scholars**, December 6–9, 2008 held at Madurai Kamaraj University, Madurai, India
   Adak, L.; Chattopadhyay, K.; Ranu, B. C. invited presentation on "*Heterogeneous Palladium Catalyst: Synthesis of (E)-2-Alkene-4-ynecarboxylic Esters, Fluorescence Emission of Selected Compounds*"

***Oral Presentations***

4. **The 95th Annual Meeting of the Chemical Society of Japan (CSJ)**, March 26–29, 2015, Nihon University, Chiba, Japan
   Adak, L.; Jin, M.; Nakamura, M. oral presentation on *"Iron-Catalyzed Enantioselective Cross-Coupling Reaction of Racemic α-Haloesters"*

5. **61st Symposium on Organometallic Chemistry**, 23–25 September 2014, Kyushu University, Japan
   Adak, L.; Kawamura, S.; Toma, G.; Li, H. C.; Takenaka, T.; Isozaki, K.; Takaya, H.; Shing, T. K. M.; Nakamura, M. oral presentation on "*Aryl C-Glycoside Synthesis Based on Iron-Catalyzed Negishi Coupling Reaction"*

6. **The Seventh Tokyo Conference on Advanced Catalytic Science and Technology**, June 1–6, 2014, Kyoto, Japan
   Adak, L.; Kawamura, S.; Toma, G.; Li, H. C.; Isozaki, K.; Takaya, H.; Shing, T. K. M.; Orita, A.; Nakamura, M. oral presentation on *"Aryl C-Glycoside Synthesis Based on Iron–Catalyzed Cross–Coupling Reaction of Arylzinc Reagents"*

7. **The 94th Annual Meeting of the Chemical Society of Japan (CSJ)**, March 27–30, 2014, Nagoya University, Japan
   Adak, L.; Kawamura, S.; Toma, G.; Li, H. C.; Takenaka, T.; Isozaki, K.; Takaya, H.; Shing, T. K. M.; Nakamura, M. oral presentation on *"Aryl C-Glycoside Synthesis Based on Iron-Catalyzed Cross-Coupling Reaction of Arylzinc Reagents"*

***Poster Presentations***

8. **The 5th International Conference on MEXT Project of Integrated Research on Chemical Synthesis**, January 29-30, 2016, Nagoya University, Japan
   Adak, L.; Jin, M.; Nakamura, M. poster presentation on *"Iron-Catalyzed Enantioselective Cross-Coupling Reaction of α-Halo Esters"*

9. **The 4th International Conference on MEXT Project of Integrated Research on Chemical Synthesis**, July10–11, 2014, Kyoto University, Japan
   Adak, L.; Kawamura, S.; Toma, G.; Li, H. C.; Takenaka, T.; Isozaki, K.; Takaya, H.; Shing, T. K. M.; Nakamura, M. poster presentation on *"Aryl C-Glycoside Synthesis Based on Iron-Catalyzed Cross-Coupling Reactions of Arylzinc Reagents"*

10. **The 2nd International Conference on Chemical Synthesis**, 10–11 December, 2012 held at Nagoya University, Japan
    Adak, L.; Yoshikai, N. poster presentation on "*Cobalt Catalyzed Preparation of Arylindium Reagents"*

11. **The 16th IUPAC International Symposium on Organometallic Chemistry Directed Towards Organic Synthesis**, 24–28 July 2011 held at Shanghai, China, Adak, L.; Jin, M.-Y.; Yoshikai, N. poster presentation on "*Preparation of Arylzinc and –indium Reagents via Cobalt Catalysis"*

12. **10th Anniversary of CRSI National Symposium in Chemistry**, February 1–3, 2008 held at Indian Institute of Science, Bangalore, India

Chattopadhyay, K.; Saha, A.; Adak, L.; Jana, R.; Bhadra, S.; Dey, R.; Saha, D.; Ranu, B. C. Poster on "*Metal Nanoparticles as Efficient Catalyst for Carbon–Carbon and Carbon–Hetero Atom Bond Formation*"

13. Attended **6th Asian-European Symposium on Metal Mediated Efficient Reactions**, 7–9 June, 2010 held at Nanyang Technological University, Singapore

## Skills and Proficiencies

- Have experiences on reviewing many scientific papers in different journals with Prof. Masaharu Nakamura (Present Advisor, Kyoto University, Japan)
- Got opportunity to supervise several graduate, undergraduate and international visiting students in their research projects at both Ph.D. and postdoctoral institutions
- Have ability to prepare manuscript for publication
- Efficient in communication both written and verbal for the relaying science to the people
- Have strong interpersonal skills and ability to work hard with effectively in multi-cultural environment
- Operational experience in FTNMR JEOL (400 MHz), FTIR (Shimadzu), High-resolution mass spectra (HRMS), LRMS mass spectrometer, GC & GC-MS (Shimadzu), HPLC, GPC, microwave reactor of SEM Discover for synthesis etc.

## References

**Professor Masaharu Nakamura**
**(Present advisor)**
Professor of Chemistry, D.Sc.
Institute for Chemical Research (ICR),
Kyoto University, Gokasho, Uji, Kyoto
611-0011, Japan
Phone No: 0081-774-38-3180
Mobile No: 0081-70-6686-3180
E-mail: masaharu@scl.kyoto-u.ac.jp

**Professor Brindaban C. Ranu**
**(Ph.D. Supervisor)**
Senior Professor, FNA
Department of Organic Chemistry
Indian Association for the Cultivation of Science
Jadavpur, Kolkata 700032, India
Phone No: +91-33-24734971 Ext.–404
Mobile No: 09433053856
E-mail: ocbcr@iacs.res.in

**Professor Naohiko YOSHIKAI**
**(Postdoctoral Advisor)**
Division of Chemistry and Biological Chemistry
School of Physical and Mathematical Sciences
Nanyang Technological University
SPMS-CBC-05-18, 21 Nanyang Link,
Singapore 637371
Phone: +65-6592-7768
E-mail: nyoshikai@ntu.edu.sg

**Professor Sreebrata Goswami**
**(Collaborative Advisor)**
Department of Inorganic Chemistry
Indian Association for the Cultivation of Science
2A & 2B Raja S. C. Mullick Road,
Jadavpur, Kolkata 700032, India
Phone No: +91-33-24734971 Ext.–356
E-Mail: icsg@iacs.res.in

# List of Publications (*Dr. Laksmikanta Adak)*

| SN | Name of Journal | Year/ Page No | Volume No. | Authors | Title of the Paper |
|---|---|---|---|---|---|
| 1 | ***J. Am. Chem. Soc.*** (Impact Factor: 12.113) Top 20 most downloaded articles in May of 2015. (Highlighted: ***SYNFACTS 2015, 11, 861)*** | **2015,** 7128–7134 | 137 | Jin, M.; **Adak, Laksmikanta;** Nakamura, Masaharu | Iron-Catalyzed Enantioselective Cross-Coupling Reactions of α-Chloroesters with Aryl Grignard Reagents |
| 2 | ***Bull. Chem. Soc. Jpn.*** (Impact Factor: 2.222) BCSJ Award Article | **2015,** 410–418 | 88 | Takaya, H.; Nakajima, S.; Nakagawa, N.; Isozaki, K.; Imayoshi, R.; Gower, N. J.; **Adak, Laksmikanta;** Hatakeyama, T.; Honma, T.; Nagashima, H.; Nakamura, Masaharu | Investigation of Organoiron Catalysis in Kumada–Tamao–Corriu-Type Cross-Coupling Reaction Assisted by Solution-Phase X-ray Absorption Spectroscopy |
| 3 | ***Tetrahedron*** (Impact Factor: 3.025) Invited contribution in honor of Prof. Zhang–Jie Shi's Tetrahedron Young Investigator Award | **2012,** 5167–5171 | 68 | **Adak, Laksmikanta;** Yoshikai, Naohiko | Iron-Catalyzed Annulation Reaction of Arylindium Reagents and Alkynes to Produce Substituted Naphthalenes |
| 4 | ***Org. Biomol. Chem.*** (Impact Factor: 3.562) Article, Inside Front Cover | **2012,** 952–957 | 10 | Saha, D.; **Adak, Laksmikanta;** Ranu, B. C. | Hydroxyapatite–Supported Cu(I)-Catalysed Cyanation of Styrenyl Bromides with $K_4[Fe(CN)_6]$: an Easy Access to Cinnamonitriles |
| 5 | ***Tetrahedron Lett.*** (Impact Factor: 2.379) | **2012,** 2149–2152 | 53 | Banerjee, S.; **Adak, Laksmikanta;** Ranu, B. C. | Ionic Liquid/$PPh_3$ Promoted Cleavage of Diphenyl Disulfide and Diselenide: A Straight–Forward Metal–Free One–Pot Route to the Synthesis of Unsymmetrical Sulfides and Selenides |
| 6 | ***J. Org. Chem.*** (Impact Factor: 4.721) | **2011,** 7563–7568 | 76 | **Adak, Laksmikanta;** Yoshikai, Naohiko | Cobalt-Catalyzed Preparation of Arylindium Reagents from Aryl and Heteroaryl Bromides |
| 7 | ***Chem. Asian J.*** (Impact Factor: 4.587) Invited Contribution in Honor of Prof. Eiichi Nakamura | **2011,** 359–362 | 6 | **Adak, Laksmikanta;** Chan, W. C.; Yoshikai, Naohiko | Nickel-Catalyzed, Directing Group-Assisted [2+2+2] Cycloaddition of Imine and Alkynes |
| 8 | ***New J. Chem.*** (Impact Factor: 3.159) | **2011,** 430–437 | 35 | **Adak, Laksmikanta** Bhadra, S.; Chattopadhyay, K.; Ranu, B. C. | Amphiphilic Allylation of Activated Alkenes by Allyl Acetates and Allylstannanes Catalyzed by Palladium Nanoparticles |

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|---|---|---|---|---|---|
| 9 | ***J. Org. Chem*.** (Impact Factor: 4.721) (Highlighted: ***SYNFACTS 2011, 3, 339)*** | **2010,** 8533–8541 | 75 | Bhadra, S.; **Adak, Laksmikanta;** Samanta, S.; Islam, A. K. M. M.; Mukherjee, M.; Ranu, B. C. | Alumina-Supported Cu (II), A Versatile and Recyclable Catalyst for Regioselective Ring Opening of Aziridines and Epoxides and Subsequent Cyclization to Functionalized 1,4-Benzoxazines and 1,4-Benzodioxanes |
| 10 | ***Tetrahedron Lett.*** (Impact Factor: 2.379) | **2010,** 3811–3814 | 51 | **Adak, Laksmikanta;** Bhadra, S.; Ranu, B. C. | Palladium (0) Nanoparticle–Catalyzed sp2 C–H Activation: A Convenient Route to Alkyl–Aryl Ketones by Direct Acylation of Aryl Bromides and Iodides with Aldehydes |
| 11 | ***Tetrahedron Lett.*** (Impact Factor: 2.379) | **2010,** 5624–5627 | 51 | Saha, D.; **Adak, Laksmikanta;** Ranu, B. C. | Palladium(0) Nanoparticles-Catalyzed Ligand–free Direct Arylation of Benzothiazoles via C-H Bond Functionalization |
| 12 | ***J. Org. Chem*.** (Impact Factor: 4.721) (Highlighted: ***SYNFACTS 2009, 8, 0937)*** | **2009,** 3982–3985 | 74 | **Adak, Laksmikanta** Chattopadhyay, K.; Ranu, B. C. | Palladium Nanoparticles–Catalyzed C–N Bond Formation. A Highly Regio– and Stereoselective Allylic Amination by Allyl Acetates |
| 13 | ***J. Org. Chem*.** (Impact Factor: 4.721) | **2008,** 5609–5612 | 73 | Ranu, B. C.; **Adak, Laksmikanta;** Chattopadhyay, K. | Hydroxyapatite–Supported Palladium–Catalyzed Efficient Synthesis of (*E*)-2-Alkene-4-ynecarboxylic Esters, Intense Fluorescence Emission of Selected Compounds |
| 14 | ***Inorg. Chem*.** (Impact Factor: 4.762) | **2008,** 11062–11070 | 47 | Samanta, S.; **Adak, Laksmikanta;** Jana, R.; Mostafa, G.; Tunonen, H. M.; Ranu, B. C.; Goswami, S. | Oxidative *ortho*-C–N Fusion of Aniline by $OsO_4$. Isolation, Characterization of Oxo–Amido Osmium(VI) Complexs, and their Catalytic Activities for Oxidative C–C Bond Cleavage of Unsaturated Hydrocarbons |
| 15 | ***Tetrahedron Lett.*** (Impact Factor: 2.379) | **2008,** 4613–4617 | 49 | Ranu, B. C.; **Adak, Laksmikanta;** Banerjee, S. | Ionic Liquid Promoted Interrupted Feist–Benary Reaction with High Diastereoselectivity |
| 16 | ***Tetrahedron Lett.*** (Impact Factor: 2.379) | **2008,** 2588–2591 | 49 | Ranu, B. C.; Bhadra, S.; **Adak, Laksmikanta** | Indium (III) Chloride-Catalyzed Oxidative Cleavage of Carbon-Carbon Multiple Bonds by *tert*-Butyl Hydroperoxide in Water-a Safer Alternative to Ozonolysis |
| 17 | ***Org. Lett*.** (Impact Factor: 6.364) | **2007,** 4595–4598 | 9 | Ranu, B. C. Chattopadhyay, K. **Adak, Laksmikanta** | Solvent-Controlled Highly Selective Bis– and Monoallylation of Active Methylene Compounds by Allyl |

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|---|---|---|---|---|---|
| | | | | | Acetate with Palladium(0) Nanoparticle |
| 18 | ***Tetrahedron Lett.*** (Impact Factor: 2.379) | **2007,** 7374–7379 | 48 | Ranu, B. C.; Banerjee, S.; **Adak, Laksmikanta** | Regioselective Cross–Coupling of Allylindium Reagents with Activated Benzylic Bromides - A Simple and Efficient Procedure for the Synthesis of Terminal Alkenes |
| 19 | ***Aust. J. Chem.*** (Impact Factor: 1.558) | **2007,** 358–362 | 60 | Ranu, B. C.; **Adak, Laksmikanta;** Banerjee, S. | Halogenation of Carbonyl Compounds by an Ionic Liquid, [AcMIm]X, and Ceric Ammonium Nitrate(CAN) |
| 20 | ***Can. J. Chem.*** (Impact Factor: 1.013) | **2007,** 366–371 | 85 | Ranu, B. C.; **Adak, Laksmikanta;** Banerjee, S. | Efficient Regio– and Stereo–Selective Cleavage of Aziridines and Epoxides using an Ionic Liquid as Reagent and Reaction Medium |
| 21 | ***Manuscript in Preparation*** | **2016** | -- | **Adak, Laksmikanta;** Kawamura, S.; Toma, G.; Isozaki, K.; Takaya, H.; Li, Ho C.; Shing, T. K. M.; Nakamura, Masaharu | Diastereoselective Synthesis of Aryl *C*-Glycosides via Iron-Catalyzed Cross-Coupling Reactions |
| | **Review Papers** | | | | |
| 1 | ***International Union of Pure and Applied Chemistry*** (Impact Factor: 3.386) | **2009,** 2337–2354 | 81 | Ranu, B. C.; Chatopadhyay, K.; **Adak, Laksmikanta;** Saha, A.; Bhadra, S.; Saha, D.; Dey, R. | Metal Nanoparticles as Efficient Catalysts for Organic Reactions |
| 2 | ***Journal of Physics: Conference Series*** | **2008,** 12003– | 106 | Ranu, B. C.; Chattopadhyay, K.; Saha, A.; **Adak, Laksmikanta;** Jana, R.; Bhadra, S.; Dey, R.; Saha, D. | Potential of Metal Nanoparticles in Organic Reactions |
| 3 | ***Acc. Chem. Res.*** (Impact Factor: 22.323) Manuscript in preparation as an Invited Review | **2016** | -- | **Adak, Laksmikanta;** Hatakeyama, T.; Nakamura, Masaharu | Iron-Catalyzed Cross-Coupling Reactions Employing *ortho*-Phenylene Bisphosphine Ligands |

## Past Research and Achievements

Dr. Laksmikanta Adak, the applicant of this research project, is well experienced in the field of synthetic organic chemistry and transition metal catalysis using a green and environmentally benign approach. During his postdoctoral and doctoral studies, he has explored in various fields of synthetic organic chemistry. It should be noted that most of the methods developed by Dr. Adak bases on very convenient procedures using easily available reagents and catalysts, and thus, they are highly expedient. These results have been published in **22** scientific papers. All the research projects and achievements are summarized below.

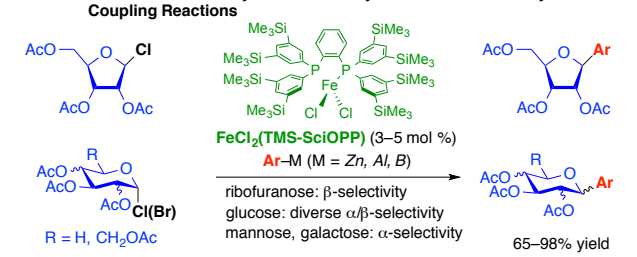
### Postdoctoral Research, Kyoto University, Japan

The following reactions have been developed by the applicant and his collaborators at Kyoto University.

***(1) Diastereoselective synthesis of aryl C-glycosides via iron-catalysed cross-coupling reactions***

We developed an efficient and environmentally benign method for the diastereoselective synthesis of *C*-glycosides via the Iron-catalysed cross coupling between aryl metal reagents and various halosugars (Scheme 1), where an iron-bisphosphine complex, $FeCl_2$(TMS-SciOPP), was proven to be an effective catalyst, providing the desired *C*-glycosides in high-to-excellent yields and with good-to-excellent anomeric selectivity. The cross-coupling reactions proceed via the generation of glycosyl radical intermediates. The anomeric diastereoselectivity of the products can mainly be explained by the stable conformations of glycosyl radicals as calculated by density functional theory calculations except for the glucosyl case.

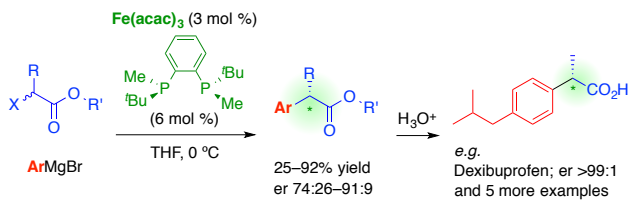
**Scheme 1. Diastereoselective Synthesis of *C*-Glycosides via Iron-Catalyzed Cross-Coupling Reactions**




***(2) Iron-catalysed enantioselective cross-coupling reactions of racemic α-haloesters with aryl Grignard reagents***

Recently, we reported the first example of iron-catalysed enantioselective cross-coupling reaction, where racemic α-haloalkanoates are coupled with ArMgBr in the presence of catalytic amounts of an Fe salt and a chiral bisphosphine ligand, BenzP*, affording the products in high yields and with good enantioselectivities (er up to 91:9) (Scheme 2, *J. Am. Chem. Soc.* **2015**, *137*, 7128–7134; *Bull. Chem. Soc. Jpn.* **2015**, *88*, 410–418; refs 1 and 2 in the publication list). The produced α-arylalkanoates were readily converted to the corresponding α-arylalkanoic acids with high optical enrichments (er up to >99:1) via simple deprotection/recrystallization. The developed asymmetric coupling method offers a practical access to various chiral α-arylalkanoic acid derivatives including dexibuprofen and naproxen with significant pharmaceutical importance.

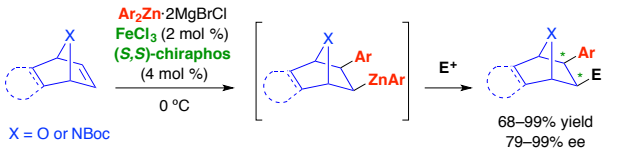
**Scheme 2. Iron-Catalyzed Enantioselective Cross-Coupling Reaction**



**(3)** ***Iron-catalysed enantioselective carbometalation reactions of oxa and azabicyclic alkenes***

Oxa and azabicyclic alkenes have been extensively studied for the catalytic enantioselective carbometalation/ring-opening reactions using palladium, rhodium, copper, and iridium catalysts, where the enantioselective addition of carbon nucleophiles provides once organometallic compounds as an intermediate, which undergoes subsequent ring-opening reactions.[1] Although the iron complexes have been used extensively in organic synthesis; however, their applications in enantioselective carbometalation have been limited to only highly strained cyclopropene derivatives.[2] We developed the iron-catalyzed enantioselective carbometalation reactions of oxa and azabicyclic alkenes using a single catalyst system for the first time (Scheme 3).

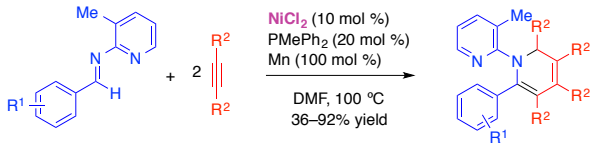
**Scheme 3. Iron-Catalyzed Enantioselective Carbometalation of Oxa and Azabicyclic Alkenes**



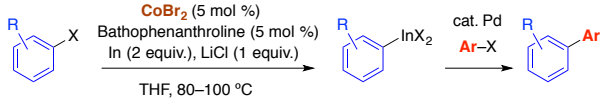

## Postdoctoral Research, NTU, Singapore

Naturally abundant first-row transition metals (e.g., iron, cobalt, and nickel) were used in the catalysis of novel synthetic organic reactions. Schemes 4 depicts an efficient synthesis of fully substituted dihydropyridine based the nickel catalysed novel [2+2+2] cycloaddition of an imine and tow molecules of an alkyne. In scheme 5, a new cobalt-catalysed preparation of arylindium reagents from aryl halides and the subsequent palladium-catalysed cross-coupling reaction are described. The arylindium compounds thus prepared was capable to undergo a novel benzannulation reaction with alkynes to afford a variety of densely substituted naphthalene compounds in the presence of catalytic amounts of $FeCl_3$ and bisphosphine ligand, DPPBz (Scheme 6). (*J. Org. Chem.* **2011**, *76,* 7563–7568; *Chem. Asian J.* **2011**, *6,* 359–362; *Tetrahedron* **2012**, *68,* 5167–5171; refs 6, 7 and 3 in the publication list, respectively).

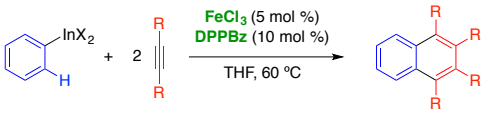
**Scheme 4. Nickel-Catalyzed Directing-Group-Assisted [2+2+2] Cycloaddition of Imines and Alkynes**




**Scheme 5. Cobalt-Catalyzed Preparation of Aryl Indium Reagents**




**Scheme 6. Iron-Catalyzed Annulation of Arylindium Reagents and Alkynes**




## Doctoral Research, IACS, Kolkata, India

My doctoral studies covered several fields of synthetic chemistry are as follows:

(i) Development of highly recyclable heterogeneous palladium and copper catalyzed synthetic organic reactions and their applications (*J. Org. Chem.* **2010**, *75,* 8533–8541; *Org. Biomol. Chem.* **2012**, *10,* 952–957; *J. Org. Chem.* **2008**, *73,* 5609–5612; refs 9, 4, and 13 in the publication list).

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(1) (a) Lautens, M.; Fagnou, K.; Hiebert, S. *Acc. Chem. Res.* **2003**, *36,* 48–58. (b) Tsui, G. C.; Lautens, M. *Angew. Chem. Int. Ed.* **2012**, *51,* 5400–5404. (c) Feringa, B. L. *et al. Org. Lett.* **2002**, *4,* 2703–2705. (d) Lou *et al. Chem. Commun.*, **2013**, *49,* 9959–9962.

(2) Nakamura, M.; Hirai, A.; Nakamura, E. *J. Am. Chem. Soc.* **2000**, *122,* 978–979.

(ii) Advances in palladium nanoparticle catalyzed organic synthesis (*Org. Lett.* **2007**, *9,* 4595–4598; *J. Org. Chem.* **2009**, *74,* 3982–3985; *New J. Chem.* **2011**, *35,* 430–437; *Tetrahedron Lett.* **2010**, *51,* 3811–3814; *Tetrahedron Lett.* **2010**, *51,* 5624–5627; *International Union of Pure and Applied Chemistry* **2009**, *81,* 2337–2354; *Journal of Physics: Conference Series* **2008**, *106,* 12003; refs 8, 10, 11, 12, 17, 22 and 23 in the publication list).
(iii) Use of indium metal and its derivatives for practical organic transformations (*J. Org. Chem.* **2011**, *6,* 7563–7568; *Tetrahedron Lett.* **2008**, *49,* 2588–2591; *Tetrahedron Lett.* **2007**, *48,* 7374–7379; refs 6, 16, and 18 in the publication list) and the development of ionic liquids as the reaction media, reagents, and catalysts for organic synthesis (*Tetrahedron Lett.* **2012**, *53,* 2149–2152; *Tetrahedron Lett.* **2008**, *49,* 4613–4617; *Aust. J. Chem.* **2007**, *60,* 358–362; *Can. J. Chem.* **2007**, *85,* 366–371; refs 5, 15, 19, and 20 in the publication list).

## Other accomplishments associated with the research achievements

The applicant supervised several graduate, undergraduate, and international visiting students in their research projects at both the Ph.D. and postdoctoral institutions (international visiting students from Bristol University and Chinese University of Hong Kong; students of Graduate School of Engineering, Kyoto University, Nanyang Technological University, Singapore, and IACS, Kolkata). By successfully accomplishing the research projects, the applicant has acquired and developed the following skills and techniques: separation and purification of organic compounds using modern chromatographic separation methods, spectroscopy (FT-IR, UV/VIS, FTNMR of $^{1}H$, $^{13}C$, and some other nuclei with single pulse and advanced pulse sequence techniques), and operational experience in HRMS, GC, and GC–MS, HPLC, GPC, and microwave reactor (SEM discover for synthesis). The applicant's personal competence is broad and covers the following fields of research: Development of novel transition-metal-catalyzed carbon–carbon and carbon–heteroatom bond formation reactions and new methods in organic synthesis, good ability to perform reactions and purification of products in milligram-to-kilogram scale, expertise in designing catalysts and synthesis schemes, experience in handling air and moisture-sensitive reactions and unstable compounds, interpreting spectroscopic data for structure elucidation and preparing scientific reports and manuscripts for publication, efficiency to identify experimental problems and solve them independently, capable of both collective and independent research, efficient in communication, both written and verbal, for communicating science to the people, and strong interpersonal skills and ability to work hard effectively in a multicultural environment.