Curriculum Vitae

Dr. Dattatry Shivajirao Bhosale
Present address: Department of Chemistry and Biochemistry,
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CAREER OBJECTIVE

I aspire to be associated with a progressive pharmaceutical company, which provides the necessary opportunities and ample scope to exhibit my skills in the domain of synthetic organic chemistry, asymmetric synthesis, Heterocyclic chemistry, carbohydrate/peptide chemistry, polymer chemistry, lipid chemistry, drug conjugation, and asymmetric catalysis.

RESEARCH EXPERIENCE

Sept. 2022– Present	**Postdoctoral Researcher** at Department of Chemistry and Biochemistry, **Mendel University**, Brno & Faculty of Chemical Technology, University of Pardubice, **Czech Republic**.
April 2018– Aug. 2022	**Postdoctoral Researcher** at Department of Infectious Diseases and Preventive Medicine, Veterinary Research Institute, Brno & Faculty of Chemical Technology, University of Pardubice, **Czech Republic**.
Nov. 2011– Aug. 2017	**Ph.D.** (**Organic Chemistry**) in Institute of Organic Chemistry and Technology, Faculty of Chemical Technology, **University of Pardubice**, **Czech Republic**.
Sept. 2010 – Sept. 2011	**Project Assistant** in National Chemical Laboratory, Division of Organic Chemistry, Pune, **India**. During this period, I have worked on the "*Development of novel antifungal agents including hybrid molecules*", under the supervision of **Dr. Hanumant B. Borate** (Sci-F).
Aug. 2009 – Aug. 2010	**Research Training** in Department of Chemistry, Deogiri College, Aurangabad, **India**. During this period, I have worked on "*Synthesis of β-enamino ketone using sulfated tin oxide (STO) development of novel synthetic methods using nanoparticles as a catalyst*", under the supervision of **Prof. Dr. Rajendra P. Pawar**.
Feb. 2009 – Aug. 2009	**Research guest work** in National Chemical Laboratory, Division of Organic Chemistry, Pune, **India**. During this period, I have worked on "*Synthesis of biologically active molecules*", under the supervision of **Dr. Subhash P. Chavan** (Sci-G).

EDUCATIONAL QUALIFICATIONS

Nov. 2011– Aug. 2017	**Ph.D.** in **Organic Chemistry**, Institute of Organic Chemistry and Technology, Faculty of Chemical Technology, University of Pardubice, **Czech Republic**, under the supervisor **Prof. Ing. Miloš Sedlák DrSc**. Thesis title: "*Selected pyridine derivatives immobilized on colloidal nanosystems for asymmetric Henry reaction and drug delivery application*"
June 2006 – May 2008	**M.Sc.** in **Organic Chemistry** (First Class, 61.92%), Department of Chemistry, Maharashtra Udaygiri Mahavidyalaya Udgir, affiliated to S. R. T. M. University Nanded, Maharashtra, **India**.
June 2003 – May 2006	**B.Sc.** in **Chemistry, Botany, Zoology** (First Class with Distinction, 68.57%), Department of Chemistry, Maharashtra Udaygiri Mahavidyalaya Udgir, affiliated to S. R. T. M. University Nanded, Maharashtra, **India**.

PUBLICATIONS

1. "Next-generation pH-triggerable lipid-based nanoparticles (LNPs) to mediate efficient functional delivery of RNAi effectors" Zdeněk Kratochvíl, **Dattary Shivajirao Bhosale**, Ganesh Selvaraj Duraisamy,Jihao Yu, Melanie Schürz, Michaela Vojníková, Qiuchen Zhang, Ivana Huvarova, Ivana Lipenská, Luboš Jelinek, Miloš Sedlák, Miroslav Havránek, Lei Fu, Daniel Růžek, Vojtěch Adam, Nicole Meisner-Köber, Zbyněk Heger, Andrew D. Miller (*Manuscript submission stage*).
2. "New and revised synthesis of aminoxylipids for the modular assembly using pH-reversible click chemistry of lipid-based nanoparticles (LNPs) that mediate the efficient functional delivery of therapeutic nucleic acids" Qinchen Zhang, Dongsheng Xie, Jihao Yu, Luboš Jelinek, Miroslav Havranek, **Dattatry S. Bhosale**, Ivana Lipenská, Lei Fu, Andrew D. Miller (*Manuscript submission stage*).
3. "Flexible synthesis of important ionizable lipid for the modular assembly of lipid-based nanoparticles (LNPs) that mediated the efficient functional delivery of therapeutic nucleic acids" Dongesheng Xie, Jiho Yu, Luboš Jelinek, Miroslav Haranek, **Dattatry S. Bhosale**, Ivana Lipenska, Lei Fu, Andrew D. Miller (*Manuscript submission stage*).
4. "Fluorescent turn-on assay for determination of glycated proteins from biological samples" Jaroslava Bezdekova, Kristyna Pavelicova, **Dattatry Shivajirao Bhosale**, Silvie Simonovska, Lenka Pavlikova, Jan Bartáček, Jan Svoboda, Miloš Sedlák, Andrew David Miller, Michal Masarik, Marketa Vaculovicova (*Manuscript submitted*).
5. "Diphyllin shows a broad-spectrum antiviral activity against multiple medically important RNA and DNA enveloped viruses" Michal Štefánik, **Dattatry Shivajirao Bhosale**, Jan Haviernik, Petra Straková, Martina Fojtiková, Lucie Dufková, Ivana Huvarová, Jiři Salált, Jan Bartáček, Jan Svoboda, Miloš Sedlák, Daniel Ruzek, Andrew D. Miller, Ludek Eyer, *Viruses*, **2022,** *14*, 345. IF 5.048.

6. "Advanced Therapeutics, Vaccinations, and Precision Medicine in the Treatment and Management of Chronic Hepatitis B Viral Infections: Where Are We and Where Are We Going" Ganesh Duraisamy, **Dattatry Bhosale**, Ivana Lipenska, Ivana Huvarova, Daniel Ruzek, Marc P. Windisch and Andrew D. Miller, *Viruses*, **2020**, *12*, 998. IF 5.048.
7. "Magnetically recoverable catalyst for the asymmetric Henry reaction based on a substituted imidazolidine-4-one copper(II) complex supported by Fe_3O_4@SiO_2 nanoparticles" **Dattatry S. Bhosale**, Pavel Drabina, Miloslav Kincl, Milan Vlček, Miloš Sedlák, *Tetrahedron: Asymmetry*, **2015**, *26*, 1300–1306. IF 2.344.
8. "Henry reaction catalyzed by recoverable enantioselective catalysts based on copper(II) complexes of α-methoxypoly(ethylene glycol)-*b*-poly(L-glutamic acid) and imidazolidine-4-one ligands" **Dattatry S. Bhosale**, Pavel Drabina, Jiří Palarčík, Jiří Hanusek, Miloš Sedlák, *Tetrahedron: Asymmetry*, **2014**, *25*, 334–339. IF 2.344. [Highlighted in **SYNFACTS**, **2014**, *10*(6), 0655].
9. "Synthesis and characterization of magnetic nanoparticles Fe_3O_4@SiO_2 decorated with amino groups" Lydie Harmand, **Dattatry Bhosale**, Ludvík Beneš, Jiří Palarčík, Andréa Kalendová, Miloš Sedlák, *Scientific papers of The University of Pardubice*, *Series A 20*. **2014**, 191-207.
10. "Synthesis and characterization of a pH-sensitive conjugate of isoniazid with Fe_3O_4@SiO_2 magnetic nanoparticles" Miloš Sedlák, **Dattatry S. Bhosale**, Ludvík Beneš, Jiří Palarčík, Andrea Kalendová, Karel Královec, Aleš Imramovský, *Bioorg. Med. Chem. Lett*., **2013**, *23*, 4692–4695. IF 2.331.
11. "One-pot synthesis of 4-alkyl-3-aryl-2,6-dicyanoanliline and their use in the synthesis of highly functionalized 2,3,5,6,7- and 2,3,4,5,7-substituted indoles" Sangmeshwar P. Sawargave, Ananada S. Kudale, Jaydeep V. Deore, **Dattatry S. Bhosale**, Jaisingh M. Divse, Subhash P. Chavan, Hanumant B. Borate, *Tetrahedron Lett.*, **2011**, *52*, 5491–5493. IF 2.683.
12. "One-pot synthesis of 2,4,5-trisubstituted imidazoles using MoO_3/SiO_2 an efficient and recyclable catalyst" Sidhanath V. Bhosale, Mohan B. Kalyankar, Santosh V. Nalage, **Dattatry S. Bhosale**, Swati L. Pandhare, Trupti V. Kotbagi, Shubhangi B. Umbarkar, Mohan K. Dongare, *Synth. Commun.*, **2011**, *41* (5), 762–769. IF 1.213.
13. "An expeditious synthesis of bioactive 4-Aryl-3,4-dihydropyrimidines using in situ generated HCl" Sunita B. Shinde, Ambadas B. Rode, Satish A. Dake, **Dattatry S. Bhosale**, Vinayak S. Sonekar and Rajendra P. Pawar, *Int. J. Ind. Chem.*, **2010**, *1* (1), 46–71. IF 0.482.
14. "P_2O_5 mediated rapid condensation of 2-aminothiophenol with aromatic aldehydes at ambient temperature, Santosh V. Nalage, Sidhanath V. Bhosale, **Dattatry S. Bhosale**, Wamanrao N. Jadhav, *Chin. Chem. Lett.*, **2010**, *21* (7), 790–793. IF 0.775.

RESEARCH AREA AND TECHNICAL SKILLS

Laboratory:

Over 13-year's experience in multi-step organic synthesis involving asymmetric synthesis, heterocyclic chemistry, carbohydrate chemistry, peptide chemistry (block copolymer), lipid synthesis, Fe-based magnetic nanoparticles, asymmetric catalysis (homogeneous/ heterogeneous), organometallic, recycling the catalyst, and drug conjugates for smart pH-dependent drug delivery.

- Excellent skills in designing organic synthetic routes and synthesis of small to complex molecules. Experience in handling moisture-sensitive, and light-sensitive reagents, and reactions. Experience scale-up process development from mg to gm scale.
- Expertise in purification techniques: such as flash column chromatography, recrystallization, and distillation.
- Structure elucidation of small to complex organic molecules by advanced spectroscopic methods such as FT-IR, FT-NMR, LCMS and MALDI-TOF, GPC, HPLC, UV/vis, XRD, DLS, BET, SEM, and specific rotation.

Computer:

- Well versed with chemistry-related database search (Sci-finder, Reaxys), software like ISIS Draw, Chem. Draw., Topspin, Mestre nova.

Personal:

- Ability to work and contribute effectively to a collaborative team environment and handle multiple projects.
- Innovative, keen learner, and team player. Multi-tasking with a high degree of accuracy and efficiency.

CONFERENCES AND POSTERS

1. Synthesis, characterization, and evaluation of aminooxy and ionizable lipids for the modular assembly of lipid-based nanoparticles for efficient delivery of therapeutic nucleic acid, European symposium on organic chemistry (ESOC-2019) in Vienna at **Austria**, 14^{th}–17^{th} July **2019**, poster no. 218.
2. 11^{th} International conference drug delivery systems at Jesuit college, Telč, **Czech Republic**, on 4^{th}-7^{th} June **2018.**
3. MSCA Marathon at the University of Padova in **Italy**, 6^{th}–8^{th} June **2017** (Participated).
4. Magnetically recoverable catalysts for asymmetric Henry reaction, 16^{th} Blue Danube Symposium on Heterocyclic Chemistry (BDHSC-16), Balatonalmádi in **Hungary**, 14^{th}–17^{th} June **2015**, P-07.
5. Henry reaction catalyzed by recoverable enantioselective catalysts based on copper(II) complexes, 20^{th} International Conference on Organic Synthesis (ICOS-20), at Budapest **Hungary**, on 29^{th} June- 4^{th} July **2014**, P-07.
6. Synthesis of recyclable copper(II) complexes derived from poly(ethylene glycol)-*b*-poly(L-glutamic acid) and amine ligands for enantioselective Henry reaction, At 15^{th} Blue Danube

Symposium on Heterocyclic Chemistry (BDHSC-15), at Palacky University in Olomouc, **Czech Republic**, on September 1st–5th, **2013**, P-012.

7. 1st CRSI ZONAL METTING, at National Chemical Laboratory, Pune, Maharashtra, **India**, on 13th–14th May **2011**.
8. National Science Day and International year of Chemistry celebrations **2011**, National Chemical Laboratory, Pune, Maharashtra, India, on 24th–25th February **2011**.
9. ASMNM-2011, National Symposium on "Advances in Synthetic Methodologies and new materials" at Shivaji University Kolhapur, **India**, on January 21st–22nd, **2011**.
10. "Drug Discovery and Nanotechnology" in Department of Chemistry, Yeshwant Mahavidyalaya, Nanded, **India** during January 27th–29th, **2008**, P- DDPP-114.

PERSONAL DETAILS

Date of birth	**:** 5th June1984	**Languages**	**:** English, Hindi, Marathi
Nationality	**:** Indian	**Passport no.**	**:** R 8148162
Marital status	**:** Married	**Permanent address**	**:** At-Indral, Post-Lasona, Tal-Deoni, Dist-Latur, 413 519, Maharashtra, India

REFERENCES

1. **Prof. Ing. Miloš Sedlák, DrSc.**
   Institute of Organic Chemistry and Technology, Faculty of Chemical Technology, University of Pardubice, Studentska 573, 532 10 Pardubice, **CZECH REPUBLIC**.
   E-mail: milos.sedlak@upce.cz
   Tel. No.: +420 46 603 7506 (7012)
2. **Prof. Andrew D. Miller**
   Department of Chemistry and Biochemistry, Mendel University, Brno, Zemědělská, **CZECH REPUBLIC**.
   E-mail: miller@0365.mendelu.cz
   Tel. No.: +420 777357253
3. **Dr. Subhash P. Chavan (Ret. Scientist-G)**
   Former Head,
   Division of Organic Chemistry, National Chemical Laboratory, Dr. Homi Bhabha road, Pashan, Pune 411008, (MH) **INDIA**.
   E-mail: sp.chavan@ncl.res.in
   Tel. No.: +91-20-2590 2289
4. **Dr. H. B. Borate (Ret. Scientist-F)**
   Division of Organic Chemistry, National Chemical Laboratory, Dr. Homi Bhabha road, Pashan, Pune 411008, (MH) **INDIA**.
   E-mail: hb.borate@gmail.com
   Tel. No.: +91

I hereby confirm the information provided by me is true is the best of my knowledge.

Sincerely,

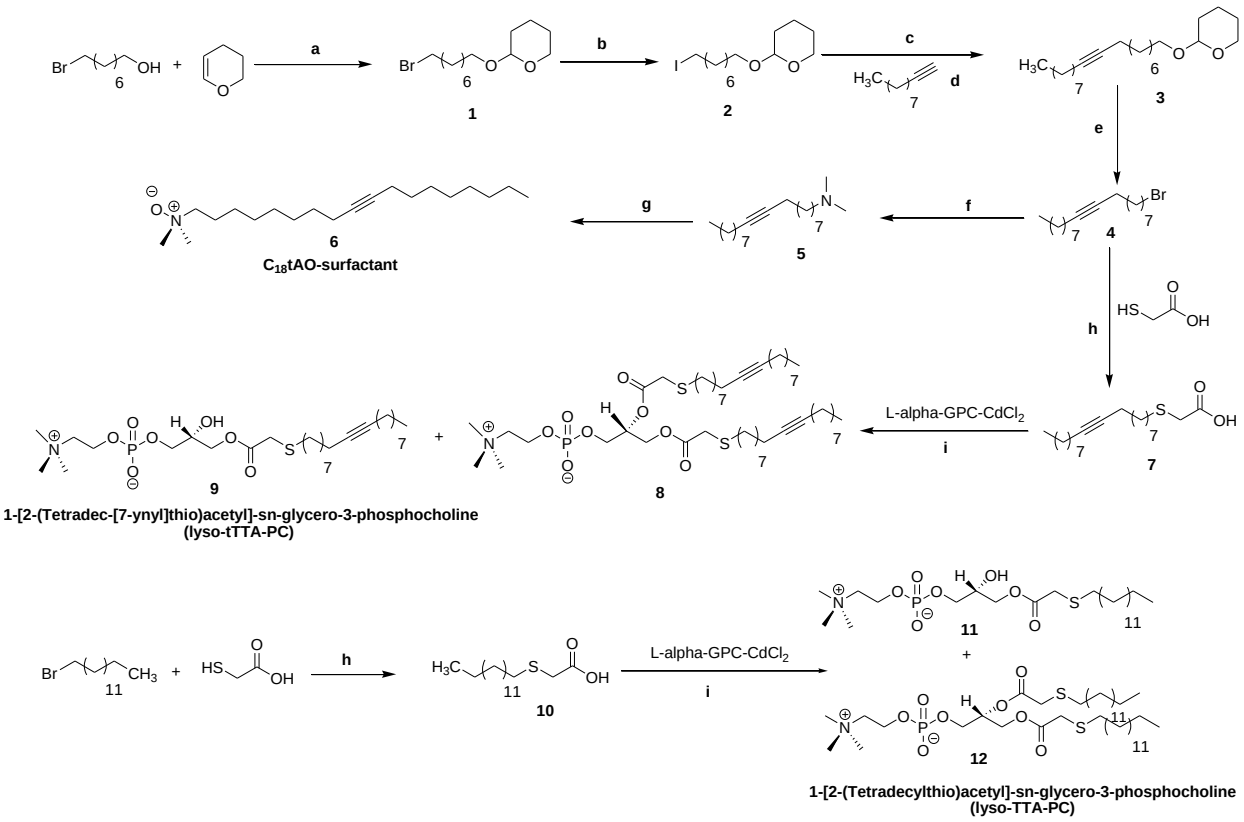
Dr. Dattatry Shivajirao Bhosale

Research Summary

1. Postdoctoral Researcher at Department of Chemistry and Biochemistry, Mendel University, Brno & University of Pardubice, Czech Republic. [Sept. 2022 – Present]

The second postdoctoral researcher's work, the main scientific focus is the design and creation of lipid-based nanoparticle drug delivery systems. To develop advances in oral vaccine design to micro/nanoparticle lipid-based vaccine delivery systems. Our approach is to mount recombinant antigen proteins and synthetic adjuvants in lipid nanoparticles (LNPs) to create a therapeutic vaccine against influenza, zika infections, and also other infection HBV, TBEV, and cancer.

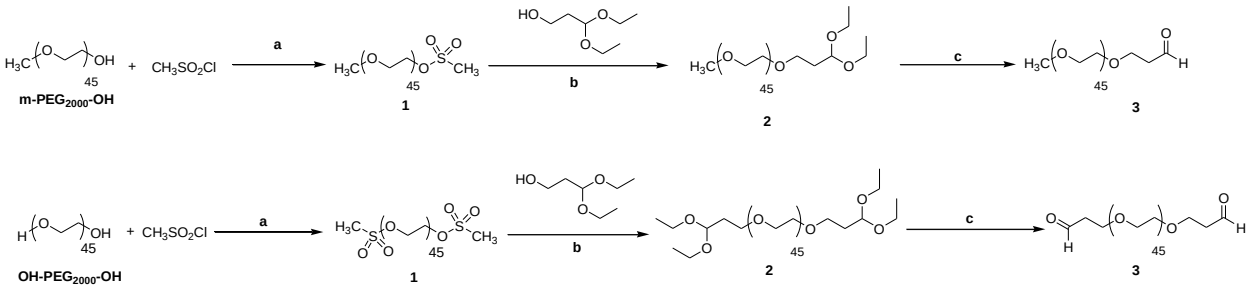
a) Design and synthesis of novel lipid-C_{18}tAO-surfactant and phospho-lipid derivatives



Scheme 1. Reagents and conditions: a) PPTs, dry DCM, 0 °C to rt, 24 h; b) NaI, Acetone N_2, reflux, 24 h; c)1-Decyne, *n*-BuLi, N_2, dry-THF, 0 °C, 6 h; d) HMPA, 0 °C, 24 h; e) $PPh_3.Br_2$, PPh_3, DCM, 0 °C to rt, 24 h; f) Dry-DMF, K_2CO_3, dimethyl amine, N_2, rt, 48 h; g) Na_2WO_4, 30% H_2O_2 in H_2O, CH_3CN, N_2, 0 °C to rt, 24 h; h) 25% NaOH, MeOH, 72 h; i) DBU, CDI, DCM, DMSO, N_2, 24 h.

The synthesis of building blocks, the methodological approach will consist of using the appropriate synthetic tools available to prepare building blocks for the synthesis of lipids conjugate and modify them with the suitable group for different applications. The completed multistep synthesis, purification, and characterization of small molecules of lipid C_{18}tAO-surfactant, lyso-TTA-PC, and lyso-*t*-TTA-PC (Scheme **1**) and the functionalization of PEG polymers (Scheme **2**) for the development of next-generation lipid-based nanoparticles (LNPs) for formulation and also click chemistry application in drug delivery.

b) Synthesis and functionalization of PEG-derivatives

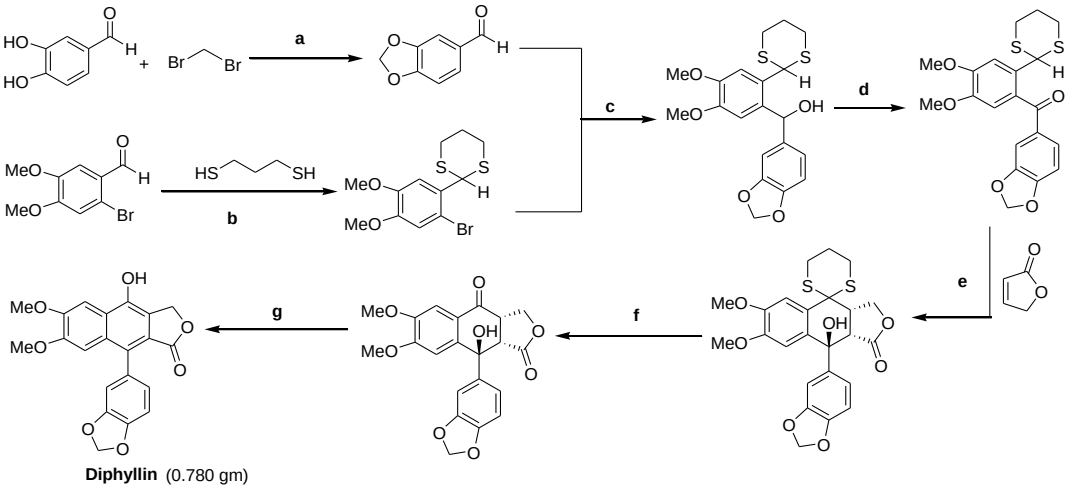


Scheme 2. Reagents and conditions: **a**) N_2, reflux, 75 h; **b**) K_2CO_3, CH_3CN, N_2, reflux, 65 h; **c**) Acid hydrolysis, rt, 1h.

2. Postdoctoral Researcher at the Department of Infectious Diseases and Preventive Medicine, Veterinary Research Institute, Brno, & University of Pardubice, Czech Republic [April 2018 – August 2022]

The first postdoctoral work was mainly concerned with the synthesis of targeted molecules according to the requirements of the European Union-funded Project-FIT (Formulation, Immunology & Toxicology). The successfully completed projects i) Design and synthesis of diphyllin analogues for antiviral studies. ii) Synthesis of anthracene boronic acid methyl acrylate (ABAM) ligand- for a rapid and simple fluorescent assay for the quantitative determination of glycated proteins in biological samples. iii) Design and synthesis of liver cell receptor targeting *N*-GalNAc-ligand. iv) Functionalization of PEG-polymers suitable for assembly and formulation of LNPs for modular click chemistry applications. v) Design and synthesis of m-PEG_{5000}-*b*-PLL-INZ conjugate for anti-tuberculosis study (Scheme **3, 4, 5, 6, 7**). Some of the molecules in the stage of vitro study screening in mouse and pig models.

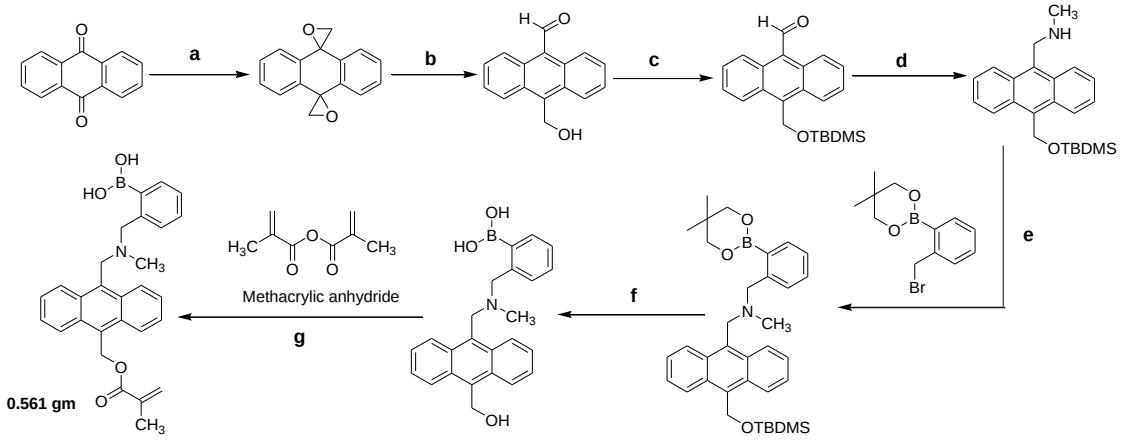
a) Synthesis and characterization of diphyllin derivatives for anti-viral studies



Scheme 3. Reagents and conditions: a) K_2CO_3, CH_3CN, N_2, reflux, 65 h; b) 90 ºC, 24 h; c) *n*-Bu-Li, THF, N_2, -78 ºC to rt, 2 h; d) MnO_2, CH_2Cl_2, rt, 16 h; e) LiHMDS, THF, N_2, -78 ºC to rt, 1 h; f) HgO, $HgCl_2$, CH_3CN, reflux, 3 h; g) *p*-TsOH, benzene, reflux, 16 h.

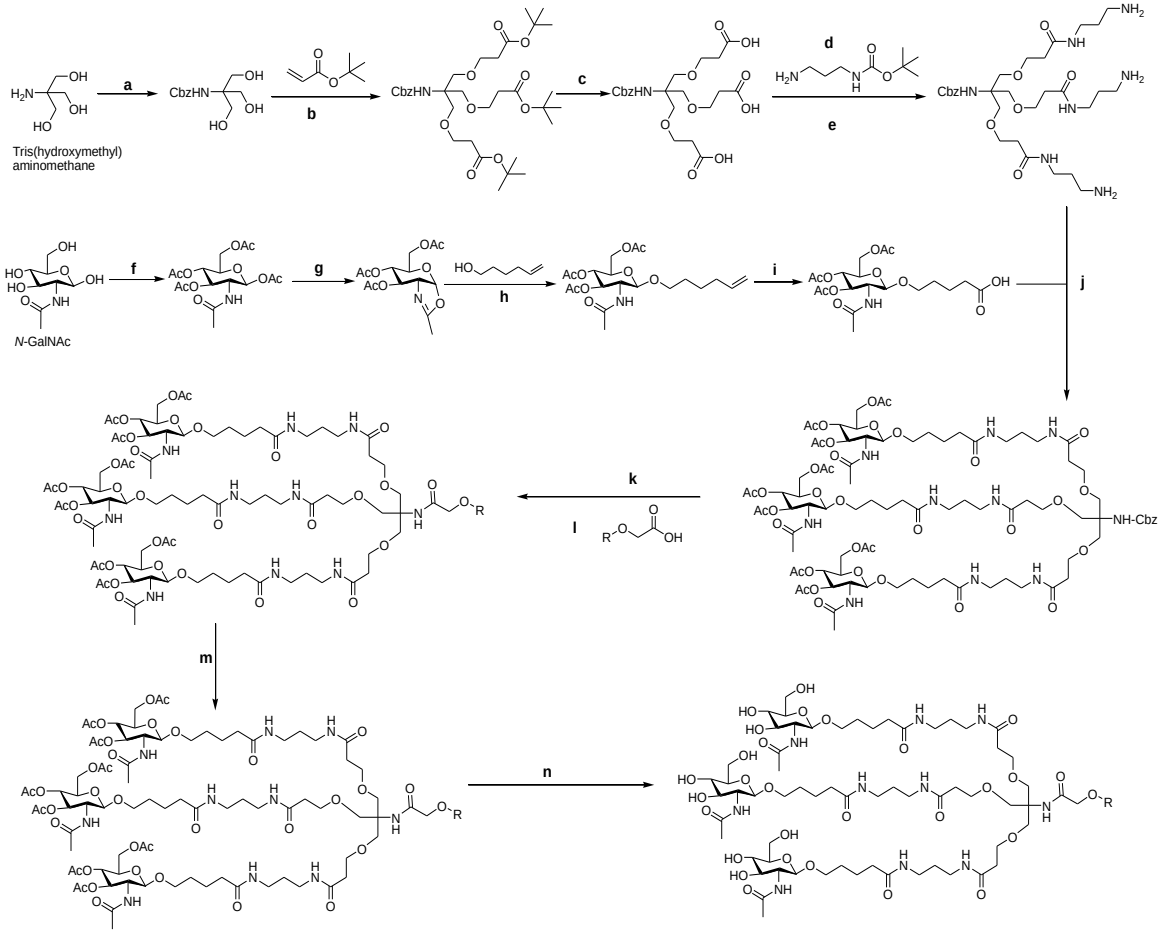
Publication: *Viruses*, **2022,** *14,* 345.

b) Synthesis and characterization of boronate chelate-ligand for fluorescent studies



Scheme 4. Reagents and conditions: **a**) DMSO, $(CH_3)_3S$-I, NaH, N_2, rt in dark, 4 h; **b**) LiBr, CH_3CN, 60 ºC, 17 h; **c**) DMF, TBDMSCl, Imidazole, rt, 20 h; **d**) i) MeOH, CH_3NH_2, N_2, 24 h; ii) $NaBH_4$, MeOH, 3 h; **e**) K_2CO_3,CH_3CN, N_2, reflux, 25 h; **f**) TBAF, THF, rt, 25 h; **g**) Methyacrylic anhydride, DMAP, DCM , 48 h.
Publication: Patent & Manuscript submitted.

c) Synthesis and characterization of *N*-GalNAc-ligand for lipid-based nanoparticles (LNPs)

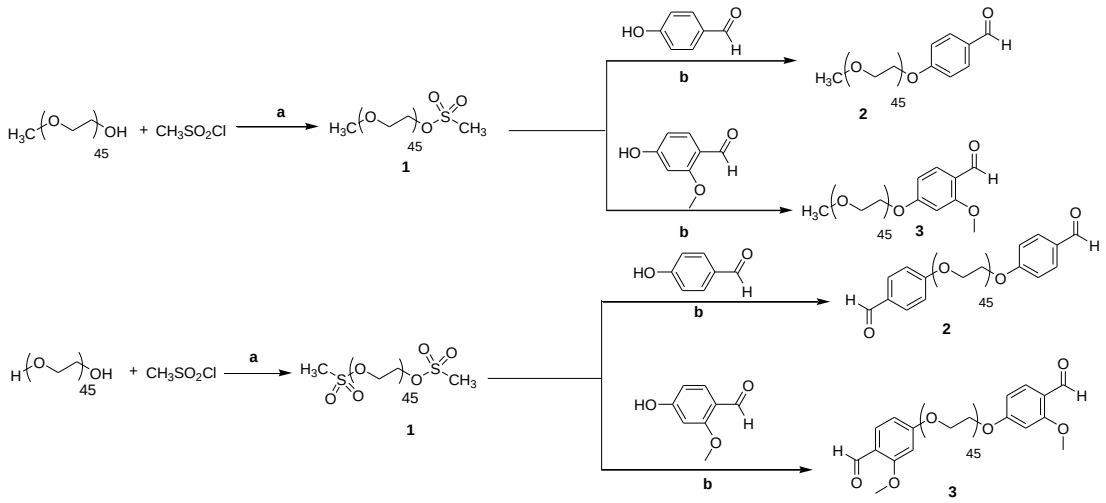


Scheme 5. Reagents and conditions: **a**) Cbz-Cl, Na_2CO_3, THF, N_2, 0 ºC, 24 h; **b**) NaOH (5 mol solution), DMSO:H_2O (9:1), rt, 48 h; **c**) HCOOH, rt, 18 h; **d**) EDCl·HCl, HOBt, DIPEA, CH_2Cl_2, N_2, 0 ºC to rt, 24 h; **e**) TFA, CH_2Cl_2, N_2, 0 ºC to rt, 24 h; **f**) Ac_2O, Pyridine, rt, 24 h; **g**) TMSOTF, CH_2Cl_2, N_2, 60 ºC, 24 h; **h**) TMSOTF, molecular sieves, DCE,

reflux, 48 h; **i**) $NaIO_4$, $RuCl_3{\cdot}H_2O$, H_2O:DCM: CH_3CN (1:1:1), rt, 24 h; **j**) EDCl·HCl, HOBt, DIPEA, CH_2Cl_2, N_2, 0 ºC to rt, 24 h; **k**) H_2. Pd/C, CH_2Cl_2, rt, 24 h; **l**) DMAP, HBTU, DMF:CH_2Cl_2 (1:1), N_2, 0 ºC to rt, 24 h; **m**) TFA, CH_2Cl_2, rt, 24 h; **n**) CH_3NH_2, EtOH, rt, 24 h.

Publication: Manuscript submission stage.

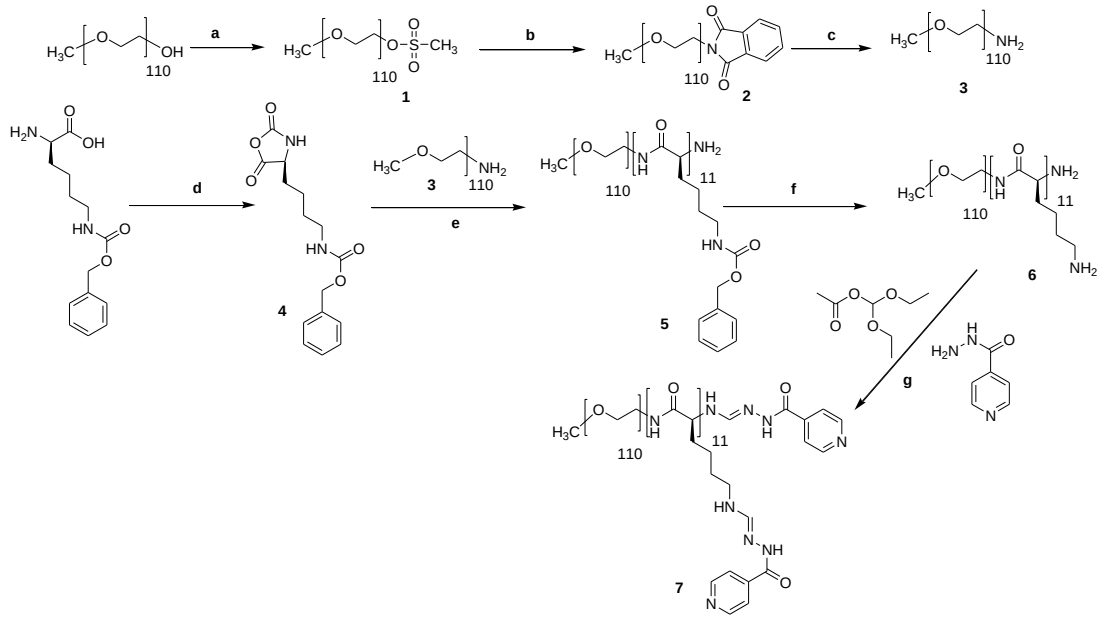
d) Synthesis and functionalization of PEG derivatives for click chemistry applications



Scheme 6. Reagents and conditions: **a**) reflux, 75 h; **b**) K_2CO_3, CH_3CN, N_2, reflux, 65

Publication: Manuscript preparation stage

e) Synthesis and characterization of new pH sensitive m-PEG_{5000}-*b*-PLL-INZ conjugate for anti--tuberculosis study in a mouse model

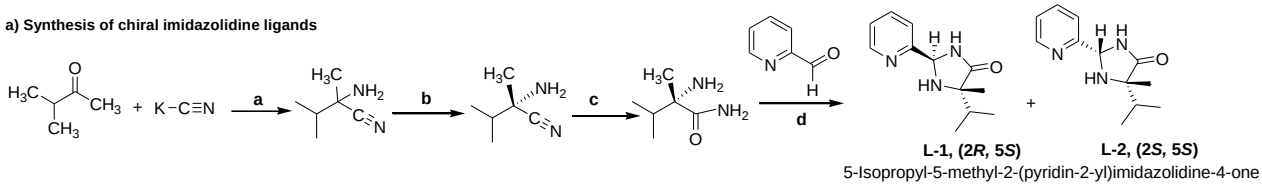


Scheme 7. Reagents and conditions: a) CH_3SO_2Cl, 70 °C, 75 h; b) Potassium phthalimide, 70 °C, 96 h; c) $NH_2NH_2{\cdot}H_2O$, EtOH, reflux, 5 h; d) $COCl_2$, THF, 40 °C, 4 h; e) m-PEG-NH_2, DMF, 40 °C, 50 h; f) TFA, rt, 24 h; g) CH_3CN, N_2, 55 °C, 25 h.

Publication: Manuscript preparation stage

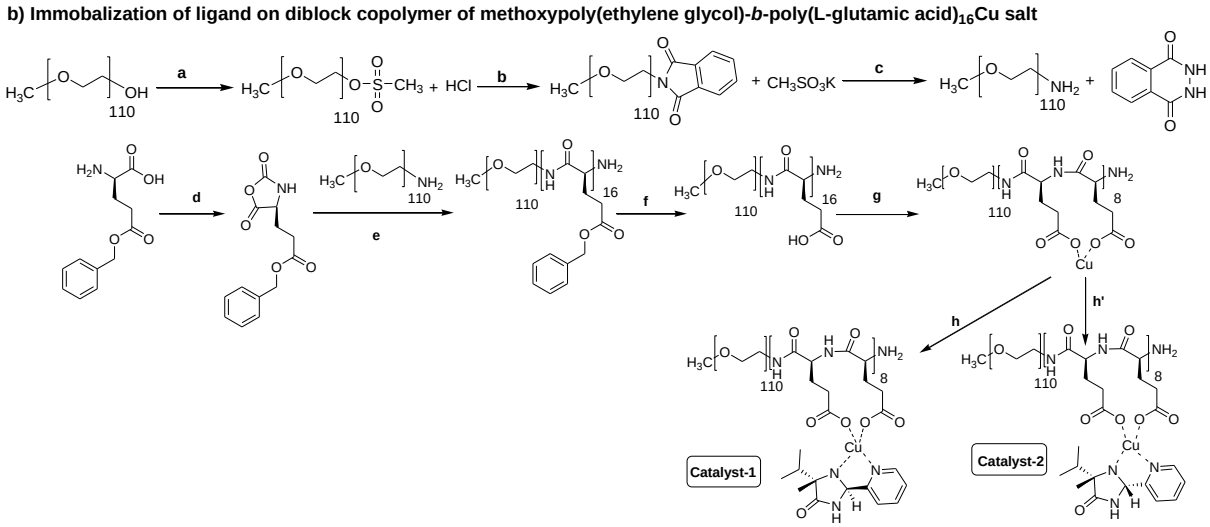
3. Doctoral (Ph.D.) study work at University of Pardubice, Czech Republic [Nov. 2011 – Aug. 2017]

In first part of study, I developed polymer supported version of **catalyst -1/2** (Scheme **9**). A synthetic route to (2*R*, 5*S*) or (2*S*, 5*S*)-5-isoprpyl-5-methyl-2(pyridine-2-yl)imdazolidne-4-one was achieved from readily available non-chiral starting material methyl isopropyl ketone (Scheme **8**).

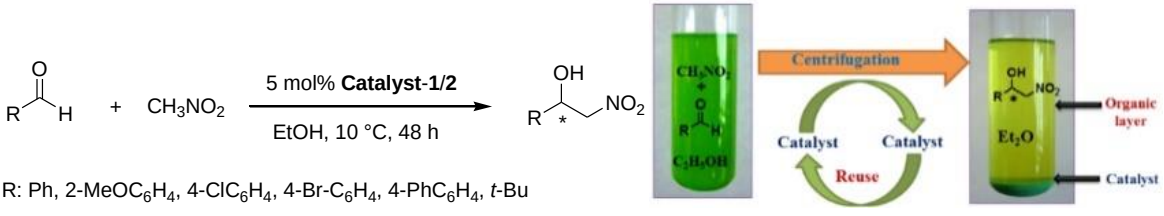


Scheme 8. Reagents and conditions: **a**) NH_3, CH_3COOH, 40 °C, 7 h; **b**) L-(+)-Tartaric acid, NaOH; **c**) H_2O, H_2SO_4; **d**) 2-Pyridinecarboxyaldehyde, CH_3OH, CH_3COOH, reflux, 7 h.

Henry reaction was performed by using a catalyst-**1**/**2** to obtain the corresponding (*R*)-2-nitro alcohols with high chemical yield (70–98%) and high enantioselectivity (61–92% ee) (Scheme **10**). The catalyst **1/2** was successfully recycled up to 10 catalytic cycles while retaining high yield and enantioselectivity.



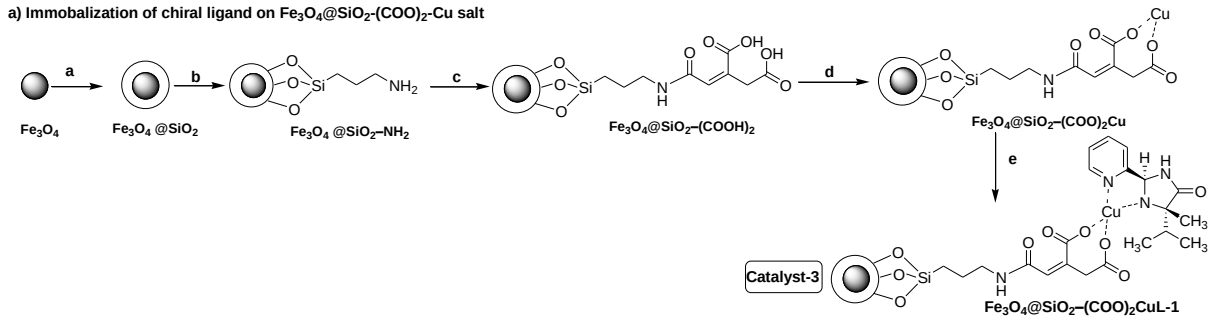
Scheme 9. Reagents and conditions: **a**) CH_3SO_2Cl, 70 °C, 75 h; **b**) Potassium phthalimide, 70 °C, 96 h; **c**) $NH_2NH_2{\cdot}H_2O$, EtOH, reflux, 5 h; **d**) $COCl_2$, THF, 40 °C, 4 h; **e**) m-PEG-NH_2, DMF, 40 °C, 48 h; **f**) Pd/C, THF, 20 bar H_2, rt, 24 h; **g**) $CuCO_3$, H_2O, rt, 24 h; **h**) Ligand-1, EtOH, rt, 24 h; **h′**) Ligand-2, EtOH, rt, 24 h.



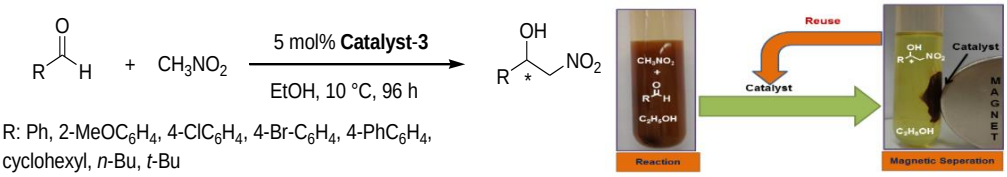
R: Ph, 2-$MeOC_6H_4$, 4-ClC_6H_4, 4-Br-C_6H_4, 4-PhC_6H_4, *t*-Bu

Scheme 10. Asymmetric Henry reaction catalyzed by polymer-supported semi-homogeneous catalyst-1/2.
Publication: *Tetrahedron Asymmetry*, **2014**, *25*, 334-339. Highlighted in **SYNFACTS, 2014**, *10*(6), 0655.

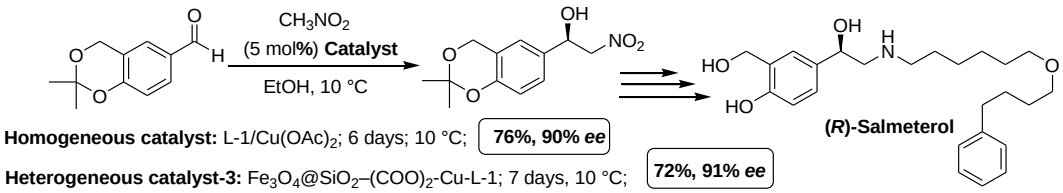
In second part of study, I developed magnetically recoverable catalyst-**3** (Scheme **11**) for the asymmetric Henry reaction and obtained the corresponding (*R*)-2-nitroalcohols with high chemical yield (82–99%) and with high enantioselectivity (68–94% ee) (Scheme **12**). The MNPs supported catalytic systems were convenient route to recycle up to ten cycles through solid-phase separation.



Scheme 11. Reagents and conditions: **a**) TEOS, 25% $2NH_3 \cdot H_2O$, EtOH, 40 °C, 4 h; **b**) APTES, *p*-TSA, Toluene, reflux, 24 h; **c**) *Cis*-aconitic anhydride, pyridine, 25 °C, 48 h; **d**) EtOH:H_2O, $CuCO_3 \cdot Cu(OH)_2$, rt, 24 h; **e**) Ligand-1, EtOH, rt, 24 h.

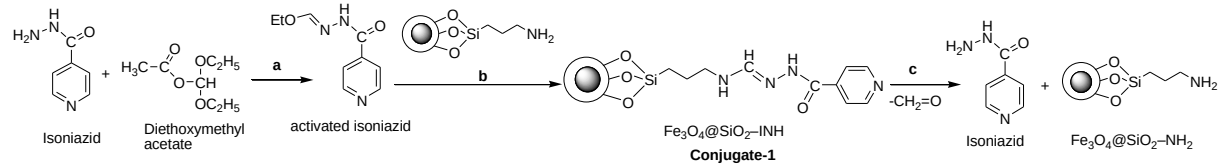


Scheme 12. Asymmetric Henry reaction catalyzed by MNPS supported heterogeneous catalyst-**3**.



Scheme 13. Enantioselectivity of homogeneous catalyst and heterogeneous catalyst-3 in the preparation of (*R*)-1-(2,2-dimethyl-4H-benzo[*d*-1,3]dioxin-6-yl)-2-nitroethanol.
Publication: *Tetrahedron Asymmetry*, **2015**, *26*, 1300-1306.

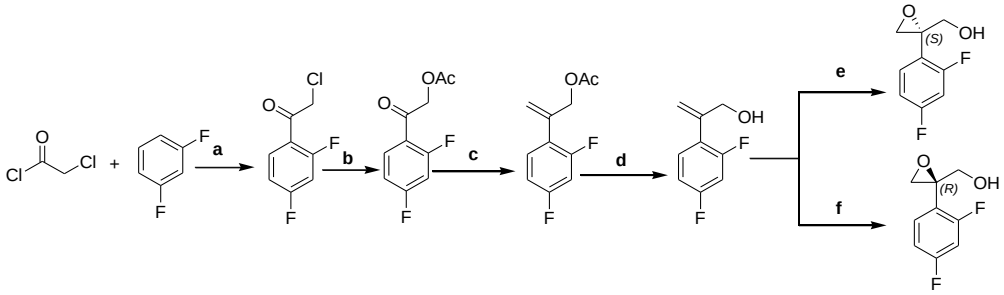
In the third part study, the synthesis of a pH-sensitive conjugate of isoniazid with Fe_3O_4@SiO_2 nanoparticles according to scheme **11**. The release of isoniazid from the nanoparticles of the conjugate-**1** under in *vitro* conditions were studied in solutions of the hydrochloric acid and phosphate buffer at 37 °C (Scheme **14**).



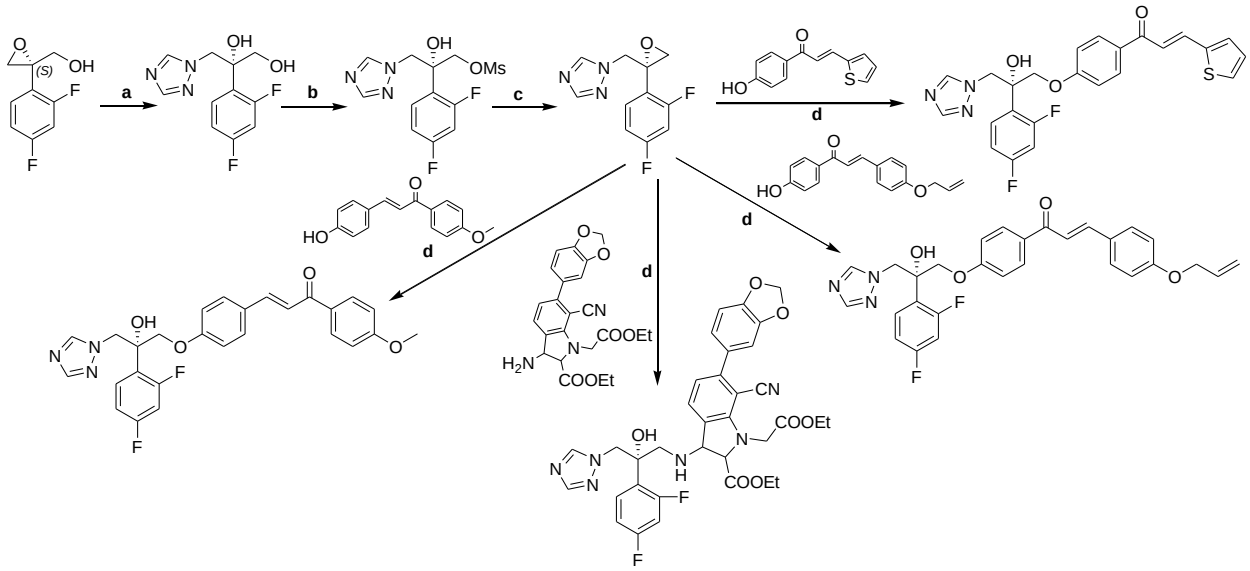
Scheme 14. Reagents and conditions: **a**) CH_3CN, 55 °C, 30 min; **b**) Fe_3O_4@SiO_2-$(CH_2)_3$-NH_2 (**17**), EtOH, ultrasonication 450 W 20 min, 25 °C, 48 h; **c**) pH different buffer solution at 37 °C
Publication: *Bioorg. Med. Chem. Lett*., **2013**, *23*, 4692–4695.

4. Project assistant work at National Chemical Laboratory, Pune, India [Sept. 2010 – Sept 2011]

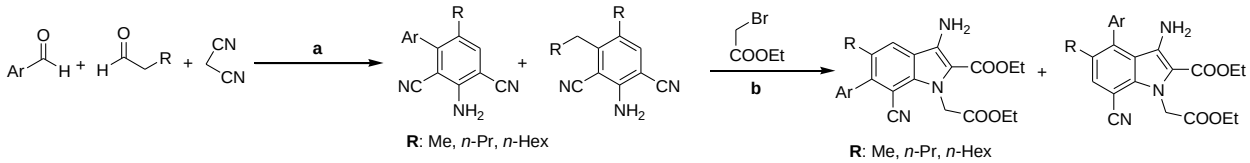
During the project assistant-II work period, I have worked on "*Development of novel antifungal agents including hybrid molecules*", under the supervision of Dr. Hanumant B. Borate (Sci-F). I was involved in design and synthesis of new chemical entities to explore their potential as antifungal agent (Scheme **15**, **16 & 17**).



Scheme 15. Reagents and conditions: **a**) $AlCl_3$, DCM, 0 °C to rt, 24 h; **b**) CH_3COONa, NaI, 3 h; **c**) Ph_3PCH_2Br, NaHMDS, THF, 0 °C to rt, 5 h; **d**) KOH, H_2O:1,4-Dioxane (1:1), 24 h; **e**) L(–)DET, Titanium(IV)isopropoxide, TBHP, DCM, –20 °C, 48 h; **f**) D(+)DET, Titanium(IV) isopropoxide, TBHP, DCM, –20 °C, 48 h.



Scheme 16. Reagents and conditions: **a**) 1,2,4-Triazole, NaH, DMF, 0 °C to rt, 24 h; **b**) MsCl, Et_3N, DCM, 0 °C, 3 h; **c**) NaH, DMF, 0 °C, 3 h; **d**) K_2CO_3, TBAB, EtOAc, reflux, 4 h.



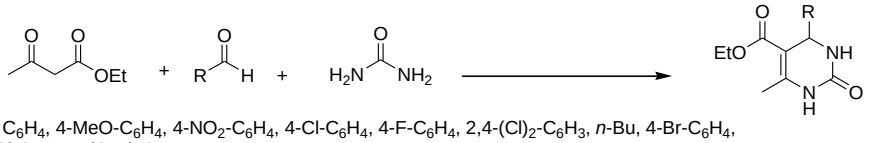
R: Me, *n*-Pr, *n*-Hex

R: Me, *n*-Pr, *n*-Hex

Scheme 17. Reagents and conditions: **a**) Morpholine, DMF, 80 °C, 12 h; **b**) KOH, CH_3CN, rt, 2 h.
Publication: *Tetrahedron Lett.*, **2011**, *52*, 5491–5493.

5. Research Training at Department of Chemistry, Deogiri College, Aurangabad, India [Aug. 2009 – Aug. 2010]

During the research training period, I have worked on "*Synthesis of β-enamino ketone using sulfated tin oxide (STO) development of novel synthetic methods using nanoparticles as a catalyst*" and "*Synthesis of bioactive 4-Aryl-3,4-dihydropyrimidines using in situ generated HCl*" (Scheme **18**), under the supervision of Prof. Dr. Rajendra P. Pawar.

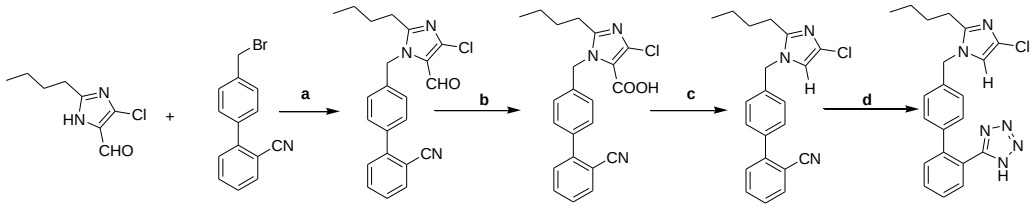


R: C_6H_4, 4-MeO-C_6H_4, 4-NO_2-C_6H_4, 4-Cl-C_6H_4, 4-F-C_6H_4, 2,4-$(Cl)_2$-C_6H_3, *n*-Bu, 4-Br-C_6H_4, 3-Cl-C_6H_4, 4-(CH_3)-C_6H_4,

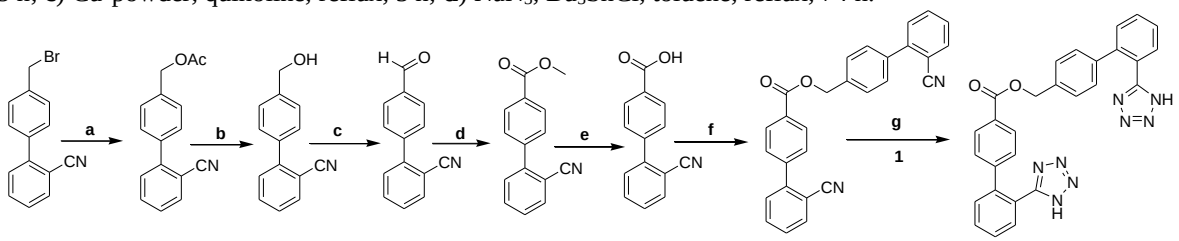
Scheme 18. Reagents and conditions: TCT, H_2O, 100 °C, 25 min.
Publication: *Int. J. Ind. Chem.*, **2010**, *1* (1), 46–71.

6. Research guest work at National Chemical Laboratory, Pune, India [Feb. 2009 – Aug. 2009]

During the research guest work period, I worked on "*Synthesis of biologically active molecules*", under the supervision of **Dr. Subhash P. Chavan** (Sci-G). I was involved in design and synthesis of novel biologically active molecules (Scheme **19** and **20**).

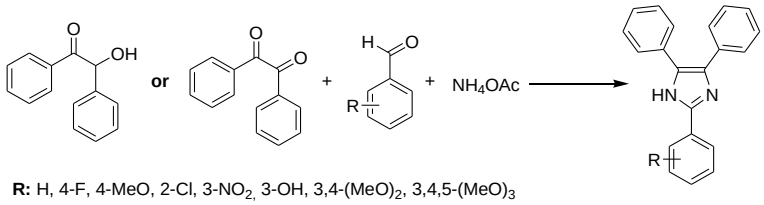


Scheme 19. Reagents and conditions: **a**) TBAB, 15% NaOH, toluene, rt, 16 h; **b**) $NaClO_2$, NaH_2PO_4, CH_3CN, H_2O_2, rt, 5 h; **c**) Cu-powder, quinoline, reflux, 5 h; **d**) NaN_3, Bu_3SnCl, toluene, reflux, 74 h.



Scheme 20. Reagents and conditions: **a**) NaI, NaOAc, DMF, 110 °C, 15 h; **b**) K_2CO_3, MeOH, rt, 5 h; **c**) MnO_2, DCM, rt, 14 h; **d**) Oxone, MeOH, rt, 15 h; **e**) KOH, THF:H_2O, reflux, 3 h; **f**) Starting bromo compound, NaI, K_2CO_3 DMF, 60 °C, 12 h; **g**) NaN_3, Bu_3SnCl, DMF, reflux, 72 h.

Also, during my research work, I worked with Dr. Mohan K. Dongare, Catalysis Division, NCL. During this period, I worked on "*Synthesis of imidazole's by using MoO_3/SiO_2 an efficient and recyclable catalyst"*(Scheme **21**).



R: H, 4-F, 4-MeO, 2-Cl, 3-NO_2, 3-OH, 3,4-$(MeO)_2$, 3,4,5-$(MeO)_3$

Scheme 21. Reagents and conditions: 20% MoO_3/SiO_2, CH_3CN, 80 °C, 4 h.
Publication: *Synth. Commun.*, **2011**, *41* (5), 762–769.