# Dr. Sudesh T. Manjare

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## EDUCATIONAL PROFILE

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| **B. Sc.** (1997 - 2000) | In **Chemistry**, **Industrial Chemistry and Mathematics** from Vidyabharati College, Sant Gadage Baba **Amaravati University**, Amaravati, Maharashtra, India |
| **M. Sc.** (2002 - 2004) | In **Inorganic Chemistry**, Department of Chemistry, T. C. College Baramati, **University of Pune**, Maharashtra, India |
| **Ph. D.** (2006 - 2012) | In **Inorganic Chemistry**, Department of Chemistry, **Indian Institute of Technology Bombay (IIT Bombay)**, Mumbai, India<br>Title: "*Studies on Novel Chalcogenone Compounds"*<br>**Supervisor: Prof. H. B. Singh** |
| **Post-Doctoral Research Fellow**<br>(Feb 2013 – April 2014) | In **Inorganic Chemistry**, Department of Chemistry, **Korea Advanced Institute of Science and Technology (KAIST),** Daejeon, South Korea as **Institute for Basic Science** Research Fellow<br>**Supervisor: Prof. David G. Churchill** |

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## PROFESSIONAL EXPERIENCE

- **Research Associate** since **Oct. 2011** to **Jan. 2013** - Department of Chemistry, **IIT Bombay**, Powai, Mumbai, India (Supervisor Prof. H. B. Singh).
- Teaching Assistant, Indian Institute of Technology Bombay, Mumbai. Tutor for under-graduate course CH-103 and CH-117L (2008).
- Worked as a Research Project Assistant in Physical and material Chemistry Division at **National Chemical Laboratory**, Pune, Maharashtra, India under **Dr. P. A. Joy** (Since **July 2005 - January 2006**) on research project sponsored by IGCAR and BARC entitled "**Preparation and characterization of SYNROC ceramic oxide**".
- **Certificate Course in Information Technology** *conducted by Board of vocational Examination, Maharashtra.*

## PROFESSIONAL RECOGNITION AND AWARDS

1. Post-doctoral Research Fellow from **Institute for Basic Science** in **Korea Advanced Institute of Science and Technology** (**KAIST**)**,** Daejeon, South Korea-2013.
2. Senior Research Fellowship, awarded by C.S.I.R., New Delhi, India - 2008.
3. Junior Research Fellowship, awarded by C.S.I.R., New Delhi, India - 2006.

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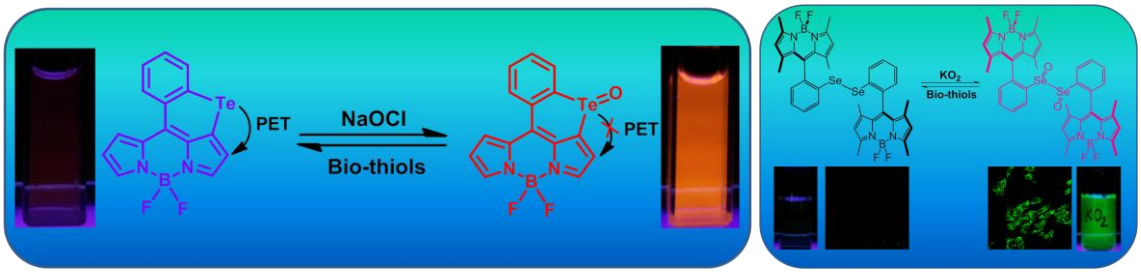
## RESEARCH INTEREST

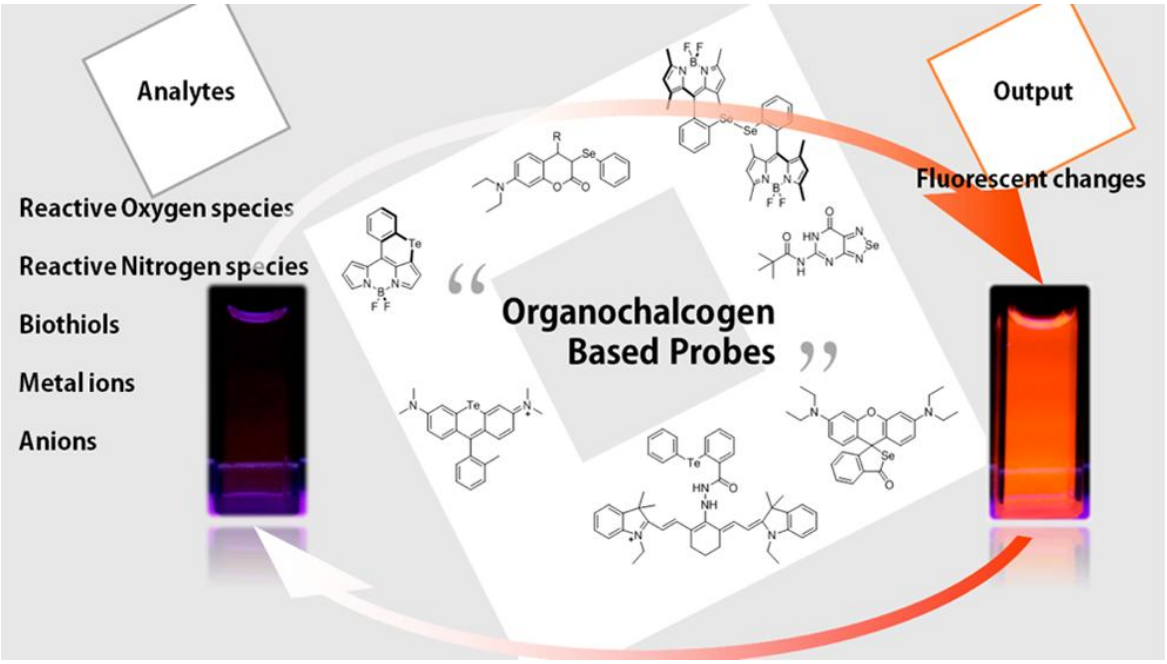
### Synthesis and Bio-applications of Chalcogen-based Small Molecular Probes




Alzheimer's disease (AD) is the most common form of dementia. Till date there is no cure for the disease, which becomes more serious as it progresses, and will lead to death. People with AD experience difficulties communicating, learning, thinking and reasoning. According to recent studies the disease is suppose to be based three main hypothesis namely Amyloid cascade, Metal ions and Reactive Oxygen Species (ROS). As metal ions and ROS are among the causes of this disease it is very important to detect them selectively.

We are interested in designing and synthesis of molecular probes based-on common fluorophore (such as BODIPY, HBT, fluorescein, rhodamine, 1,8-naphthalamide,

etc) and chalcogen atoms. Designing and synthesis of new chelating pockets with common fluorophore. These probes can be use for the selective and sensitive detection of various analytes (such as ROS, bio-thiols, amino acids, metal ions and anions) through fluorescence turn ‘ON’ or ‘OFF’.

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## RESEARCH SUMMARY

My Ph.D. work deals with the study on novel *N*-heterocyclic carbene based chalcogenones. Our focused was mainly on the synthesis and characterization of novel N-heterocyclic carbene based chalcogenones and its derivatives. We reported the synthesis and characterization of chalcogenone compounds and their oxidative addition reactions with various halogens (chlorine, bromine and iodine). All the compounds were characterized by various analytical techniques and some of them by single crystal X-ray analysis. The DFT calculations show that the chalcogen atoms have a partial negative charge and the carbene carbon acquires a partial positive charge.

A novel redox reaction between dihaloselenone and tellurium was discovered. Selenone stabilized monomeric tellurium tetraiodides were synthesized from the reaction of dihaloselenones with tellurium powder. Next, the reactions of dihaloselenones with copper and bismuth metals were carried out, which yield CuBr and tetrameric $Bi_4I_{12}$ cluster respectively stabilized by selenones. Then, the oxidation reactions of selenones/dihaloselenones with silver tetrafluoroborate, HCl and hydrogen peroxide were performed. The reactions afforded iodonium ion, cationic diselenides and monomeric selenium dioxides stabilized by selenones respectively.

Synthesis of the pincer type benzimidazolium salts and their reactions with chalcogen nucleophiles were established. The reactions yield pincer type

bis(chalcogenones). The bis(selenones) were oxidized with various halogens. A monomeric $HgCl_2$ complex with bis(selenones) has been isolated and characterized.

In post-doc, I worked on the synthesis and properties of fluorescence molecules: Reactive oxygen species (ROS) exist in, and are utilized by biology and neurobiology, yet they constitute so–called oxidative stress when present in unwanted excess. This may be a major contributing factor for diseases such as diabetes, cancer and molecular neurodegenerative disorders such as Alzheimer's and Parkinson's disease. Reactive oxygen species (ROS) are often mentioned in conjunction with nitrogen–based analogues (RNS), and include various species such as HOCl, $OH^{\cdot}$, $H_2O_2$, NO, $ONOO^{-}$, $O_2^{\cdot -}$, tBuOOH and, $tBuO^{\cdot}$. Sensitive and selective detection of such species with fluorescence microscopy requires discrete synthetic molecular design and syntheses that are straight–forward and good yielding. A great number of novel heterocycles bearing single or multiple nitrogen, oxygen, sulphur, selenium or tellurium sites have been investigated over the years; many of these are heterocyclic pharmacophores bearing biological activity. One important challenge for organochalcogen chemists has been to synthesize novel heterocyclic systems and dichalcogen-based reversible probes. Thus, here we focused on the synthesis of novel annulated BODIPY chalcogenide (Se, Te) systems and diselenide-based BODIPY probes from their respective bis(*o*–formyl–phenyl)dichalcogenide intermediates. The annulated BODIPY selenide product was confirmed by X–ray diffraction. The red–shifted annulated BODIPY telluride version was found to be sensitive and selective for hypochlorite, reversible upon treatment with bio–thiols in water. Methyl–substituted BODIPY–based diselenide probe was found to be sensitive and selective for superoxide in giving [-Se(O)Se(O)-] oxidation. Probing was reversible through bio–thiols. Practical medicinal utility of BODIPY–based diselenide was demonstrated in MCF–7/ADR cancer cells for the detection of superoxide.

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## RESEARCH PROJECTS:

1) **"START-UP RESEARCH GRANT (YOUNG SCIENTISTS)**

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| **Project Title** | **:** Development of Chalcogen-Containing Probes for the Detection of Biologically Important Analytes. |
| **Funding Agency** | **: Science and Engineering Research Board (SERB)**, **Department of Science and Technology (DST)**, Government of India. |
| **Amount** | **:** Rs. 23.00 Lakhs |
| **Period** | **:** 2015 – 2018 |

2) **"START-UP GRANT FOR NEWLY RECRUITED FACULTY"**

**Project Title** **:** Development of small molecular probes for the detection of reactive oxygen species.

**Funding Agency** **: University Grants Commission New Delhi**

**Amount** **:** Rs. 6.00 Lakhs

**Period** **:** 2015 – 2017

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## PUBLICATIONS

1. Dipyrazolopyridine probe for the selective detection of hypochlorite in living cancer cells, YoungSam Kim, **Sudesh T. Manjare**, Minsuk Choi, Sangyong Jon, David G. Churchill, ***CNS & Neurological Disorders-Drug Targets,* 2015** *(Accepted)* (Impact Factor 2.628).
2. Bis(chalcogenones) as pincer ligands: isolation and Heck activity of the selone-ligated unsymmetrical C,C,Se-Pd pincer complex, Ninad Ghavale, **Sudesh T. Manjare**, Harkesh B. Singh, Ray J. Butcher, ***Dalton Trans.*** 2015, DOI: 10.1039/c5dt01565k (Impact Factor 4.097).
3. $H^{+}$–Assisted Fluorescent Differentiation of $Cu^{+}$ and $Cu^{2+}$: Effect of $Al^{3+}$–induced acidity on chemical sensing and generation of two novel and independent logic gating pathways, Yonghwang Ha, Dhiraj P. Murale, Changsuk Yun, **Sudesh T. Manjare**, Hyungjun Kim, Juhyoun Kwak, Yoon Sup Lee, David G. Churchill, ***Chem. Commun***., **2015**, 51, 6357 (Impact Factor 6.786).
4. Selenium- and Tellurium-Containing Fluorescent Molecular Probes for the Detection of Biologically Important Analytes, **Sudesh T. Manjare**, Youngsam Kim, David G. Churchill, ***Acc. Chem. Res.* 2014**, *47,* 2985−2998 (Impact Factor 24.348).
5. A selective fluorescent probe for cysteine and its imaging in live cells, Youngsam Kim, Minsuk Choi, Seokjun Seo, **Sudesh T. Manjare**, Sangyong Jon David G. Churchill, **RSC Adv**., **2014**, *4*, 64183–64186 (Impact Factor 3.708).
6. Crystal structure of ($N^{1}$-benzyl-$N^{1}$,$N^{2}$,$N^{2}$-trimethylethane-1,2-diamine-$k^{2}$N,N')dichloridomercury(II), **Sudesh T. Manjare**, Harkesh B. Singh, Ray J. Butcher ***Acta Cryst.* 2014**, *E70*, 118-120.
7. Selective and Sensitive Superoxide Detection with a New Diselenide Based Molecular Probe in Living Breast Cancer Cells, **Sudesh T. Manjare**, Sungsoo Kim, Won Do Heo, David G. Churchill ***Org. Lett***. **2014**, *16*, 410−412 (Impact Factor 6.324).

8. Facile meso-BODIPY Annulation and Selective Sensing of Hypochlorite in Water, **Sudesh T. Manjare**, Jin Kim, Yunho Lee, David G. Churchill ***Org. Lett***. **2014**, *16*, 520−523 (Impact Factor 6.324).
9. Fluorescence probing of the ferric Fenton reaction via novel chelation, Dhiraj P. Murale, **Sudesh T. Manjare**, Yoon-Sup Lee, David G. Churchill ***Chem. Commun***., **2014**, *50*, 359−361 (Impact Factor 6.786).
10. Novel selective and reversible $Zn^{2+}$–assisted biological phosphate "turn–on" probing via attenuation of ligand hydrolysis through stable aryl–hydrazone salicylaldimine conjugation, Olga G. Tsay, **Sudesh T. Manjare**, Hyungjun Kim, Kang Mun Lee, David G. Churchill ***Inorg. Chem***. **2013**, *52*, 10052−10061 (Impact Factor 4.794).
11. Redox Reaction between Main-Group Elements (Te, Sn, Bi) and N-Heterocyclic-Carbene-Derived Selenium Halides: A Facile Method for the Preparation of Monomeric Halides, **Sudesh T. Manjare**, Sangeeta Yadav, Ray J. Butcher, Harkesh B. Singh, ***Eur. J. Inorg. Chem***. **2013**, 5344–5357 (Impact Factor 2.965).
12. Oxidation of Carbene Derived Selenium Diiodide with Silver Tetrafluoroborate: Isolation of Iodonium Ion Complexes with Selenones, **Sudesh T. Manjare**, Ray J. Butcher, Harkesh B. Singh ***Eur. J. Inorg. Chem***. **2013**, 2161–2166 (Impact Factor 2.965).
13. Synthesis and Glutathione Peroxidase-like activity of N-heterocyclic carbene derived cationic diselenides, **Sudesh T. Manjare**, Ray J. Butcher, Harkesh B. Singh ***Tetrahedron* 2012,** *68*, 10561-10566 (Impact Factor 2.817).
14. Facile Synthesis of Benzazolin-2-chalcogenones: Nature of the Carbon-Chalcogen Bond, **Sudesh T. Manjare**, Sagar Sharma, Harkesh B. Singh, Ray J. Butcher ***J. Organomet. Chem.* 2012**, *717*, 61-74(Impact Factor 2.302).
15. N-[2-(2-Bromobenzylamino)phenyl]-N-Butylformamide, **Sudesh T. Manjare**, Ray J. Butcher, Harkesh B. Singh *Acta Cryst*. **2009**, *E65*, o2826.
16. 1-(2-Bromobenzyl)-3-isopropylbenzimid-azolin-2-one, **Sudesh T. Manjare**, Ray J. Butcher, Nidhi Goel, Udai P. Singh, Harkesh B. Singh ***Acta Cryst.* 2009**, *E65*, o2836.
17. N-(2-Bromobenzyl)-N'-(2-pyridyl)-benzene-1,2-diamine, **Sudesh T. Manjare**, Harkesh B. Singh, Ray J. Butcher ***Acta Cryst.* 2009**, *E65*, o2640.

## Manuscript Submitted

18. Solvent–controlled novel Cu+ and Cu+/2+ fluorescent Turn-ON probing, Yonghwang Ha, Dhiraj P. Murale, **Sudesh T. Manjare**, Minseong Kim, David G. Churchill, ***Bulletin of the Korean Chemical Society***, **2015** (submitted).

**19.** One Pot Synthesis of Diselenide Probe and Highly Selective Sensing of Cysteine and Hypochlorite, Sudesh T. Manjare, Youngsam Kim, Ravi Kumar, David G. Churchill, (Manuscript under preparation)

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## PRESENTATIONS IN CONFERENCES

1. **Invited talk** at **National Conference** on Frontiers of Chemistry and Materials – 2015 on 14th February, **2015** at T. C. College, Baramati, Maharashtra.
2. Selective, Sensitive and Reversible Detection of ROS with a Novel *Chalcogen*–based Molecular Probes, **Sudesh T. Manjare,** David G. Churchill invitation for **Oral presentation** in the (Korean Chemical Society) KCS meeting, Korea (April 16~18, **2014**).
3. Selective, Sensitive and Reversible Superoxide Detection with a New Diselenide–based Molecular Probe: Clear Detection Capabilities in Living Breast Cancer Cells, **Sudesh T. Manjare,** Sungsoo Kim, Won Do Heo, David G. Churchill poster presentation at the "6$^{th}$ Korea Chemosensor Symposium" held at Seoul, South Korea (January **2014**) and received **best poster award**.
4. Oxidation of Elemental Tellurium with *N*-Heterocyclic Carbene Derived Selenium Halides, **Sudesh T. Manjare**, Harkesh B. Singh and Ray J. Butcher, **oral presentation** and poster presentation at HALCHEM-VI - Sixth International Meeting on Halogen Chemistry at **Indian Institute of Science, Bangalore**, India (Dec. 8-11, **2012**).
5. Synthesis and Characterization of Monomeric Tellurium Tetrahalides Stabilized by Selenones, **Sudesh T. Manjare**, Harkesh B. Singh and Ray J. Butcher, poster presentation at the national symposium on the "*New Horizons in Chemistry*" held at **Department of Chemistry, IIT Bombay**, India (Oct. 3-4, **2011**).
6. Synthesis and Characterization of Monomeric Tellurium Tetrahalides Stabilized by Selenones, **Sudesh T. Manjare**, Harkesh B. Singh and Ray J. Butcher, poster presentation at ***3$^{rd}$ Indo-German Symposium*** *on* "*Frontiers of Chemistry*" held at **Department of Chemistry, IIT-Bombay**, India (Sep. 27-28, **2011**).
7. Synthesis and Characterization of Chalcogenone Compounds, **Sudesh T. Manjare**, Harkesh B. Singh and Ray J. Butcher, Presented a poster at the "***Royal Society of Chemistry (RSC) Symposium***" on the Chemical Sciences at the **Department of chemistry, IIT Bombay**, India (**2009**).

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