

Dr. Amit Sharma  
DBT-Ramalingaswami Fellow Ubiquitous Analytical Techniques  
Email: [amit.sharma@csio.res.in](mailto:amit.sharma@csio.res.in);  
[amitorg83@gmail.com](mailto:amitorg83@gmail.com)  
<https://scholar.google.com/citations?hl=en&user=VQfCGw8AAAAJ>



### **Current Opening:**

We are currently looking for enthusiastic students with a specialization in organic chemistry, bio-organic chemistry. Interested students can contact through email.

### **Research Area:**

Organic chemistry, Chemical Biology, Cancer diagnosis and therapeutics

### **Research Focus:**

Our research group is working on interdisciplinary themes. Our research work mainly focused on the synthesis of molecular constructs, their characterizations, understanding photophysical properties, and application in chemical biology, and material sciences. Related research directions are described below:

#### **Synthesis and validation for diagnostic probes for Cancer:**

Clinical imaging is the traditional cornerstone of cancer diagnosis. Advancement in medical imaging strategies for visualizing tumor lesions can significantly aid the diagnosis, surgical resection and therapeutic efficacy of chemotherapeutic treatment in cancer. Particularly, probes based upon fluorescence, chemiluminescence, and photoacoustic imaging (PA) has potential with high specificity, and sensitivity. Over the past decades, significant efforts have been devoted to this particular area. In our research group, we are focused on developing new small molecular probes (fluorescence, chemiluminescence, and PA-based), including their designing and application in medical imaging.

#### **Molecular theranostic for Cancer Chemotherapy:**

Theranostic systems have received ever-increasing attention due to potential imaging and therapeutic utility. Under the precision medicine initiative, such systems have shown promises in advancing diagnosis, staging, and therapy of cancer. Our research group is focused on developing such systems for cancer-selective targeting, activation, visualization of drug action, and treatment in pre-clinical tumor models. As an activation strategy, specific Cancer related overexpressed cellular entities such as, thiols, reactive oxygen species, enzymes are explored. Particular interests are in developing theranostic systems for drug resistance tumors models.

#### **Molecular systems for Cancer targeted photodynamic therapy:**

Photodynamic therapy (PDT) is an emerging, non-invasive therapeutic strategy for cancer. PDT involves photosensitizer (PS), light source, and molecular oxygen to generate reactive oxygen species and subsequently kill the cancer cells. Despite the significant progress of PDT, its clinical application are still hampered due to low cancer selectivity of PS, tumor hypoxia (low oxygen at tumor site), and low penetration depth of laser source. Our research is focused on developing new

strategies to overcome such limitations. Further, developing instrumentation setups (PDT, photothermal therapy (PTT)) for cell-based studies is also our focus.

### **Combinational therapeutic approaches for overcoming drug resistance in Cancer:**

Combination therapy means a treatment modality that makes use of two or more therapeutic agents is a cornerstone in cancer therapy. As compared to mono-therapeutic approach, combinational approaches are advantageous as the amalgamation of more than one approach targets the cancer survival key pathways in a synergetic and additive manner. Such strategies help to overcome the resistance arising from mono-therapy and simultaneously provide the therapeutic anti-cancer benefits. Our research group is focused on developing molecular constructs consisting of chemotherapy in combination with other existing therapeutic modalities (immunotherapy, photodynamic therapy, photothermal therapy, and sonodynamic therapy). Both molecular and nano-formulation approaches are adapted for better clinical outcomes.

### **Selected Publications:**

1. Subin Son, Ji Hyeon Kim, Xianwen Wang, Chuangli Zhang, Shin A Yoon, Jinwoo Shin, **Amit Sharma**,\* Min Hee Lee,\* Liang Cheng,\* Jiasheng Wu,\* Jong Seung Kim.\* “Multifunctional Sonosensitizers in Sonodynamic Cancer Therapy” *Chem. Soc. Rev.* **2020**, *49*, 3244-3261.
2. **Amit Sharma**,<sup>‡</sup> Min-Goo Lee,<sup>‡</sup> Miae Won, Seyoung Koo, Jonathan F. Arambula, Jonathan L. Sessler,\* Sung-Gil Chi,\* Jong Seung Kim.\* “Targeting Heterogeneous Tumors Using a Multifunctional Molecular Prodrug” *J. Am. Chem. Soc.* **2019**, *141*, 15611–15618 (**Front Journal Cover**).
3. Lei Shi, Yan-Hong Liu, Kun Li,\* **Amit Sharma**, Kang-Kang Yu, Myung Sun Ji, Ling-Ling Li, Qian Zhou, Hong Zhang, Jong Seung Kim,\* Xiao-Qi Yu.\* “An AIE-Based Probe for Rapid and Ultrasensitive Imaging of Plasma Membranes in Biosystems” *Angew. Chem. Int. Ed.* **2019**, *59*, 9962-9966.
4. Rajesh Kumar,<sup>‡</sup> **Amit Sharma**,<sup>‡</sup> Hardev Singh,<sup>‡</sup> Paolo Suating,<sup>‡</sup> Hyeong Seok Kim, Kyoung Sunwoo, Inseob Shim, Bruce C. Gibb,\* Jong Seung Kim.\* “Revisiting Fluorescent Calixarenes: From Molecular Sensors to Smart Materials” *Chem. Rev.* **2019**, *119*, 9657–9721.
5. Wei Tao,<sup>‡\*</sup> Na Kong,<sup>‡</sup> Xiaoyuan Ji,<sup>‡</sup> Yupeng Zhang,<sup>‡</sup> **Amit Sharma**,<sup>‡</sup> Jiang Ouyang, Baowen Qi, Junqing Wang, Ni Xie, Chulhun Kang,\* Han Zhang,\* Omid C. Farokhzad,\* Jong Seung Kim.\* “Emerging Two dimensional Monoelemental Materials (Xenes) for Biomedical Applications” *Chem. Soc. Rev.* **2019**, *48*, 2891–2912 (**Front Journal Cover**).
6. Bhowmira Rathore,<sup>‡</sup> Kyoung Sunwoo,<sup>‡</sup> Paramesh Jangili,<sup>‡</sup> Jiseon Kim, Ji Hyeon Kim, Meina Huang, Jia Xiong, **Amit Sharma**,\* Zhigang Yang,\* Junle Qu,\* and Jong Seung Kim\*. “Nanomaterial Designing Strategies Related to Cell Lysosome and Their Biomedical Applications: A Review” *Biomaterials* **2019**, *211*, 25–47.
7. Subin Son,<sup>‡</sup> Miae Won,<sup>‡</sup> Ori Green,<sup>‡</sup> Nir Hananya,<sup>‡</sup> **Amit Sharma**,<sup>‡</sup> Yukyoung Jeon, Jong Hwan Kwak,\* Jonathan L. Sessler,\* Doron Shabat\* and Jong Seung Kim\*. “Chemiluminescent Probe for the In Vitro and In Vivo Imaging of Cancers Over-expressing NQO1. *Angew. Chem. Int. Ed.* **2019**, *58*, 1739 –1743.
8. **Amit Sharma**,<sup>‡</sup> Jonathan L Arambula,<sup>‡</sup> Seyoung Koo, Rajesh Kumar, Hardev Singh, Jonathan L Sessler\* and Jong Seung Kim.\* “Hypoxia-Targeted Drug Discovery” *Chem. Soc. Rev.* **2019**, *48*, 771–813 (IF = 40.443; <sup>‡</sup>Equal Contribution), (**Front Journal Cover**).
9. **Amit Sharma**,<sup>‡</sup> Min-Goo Lee,<sup>‡</sup> Hu Shi,<sup>‡</sup> Miae Won, Jonathan F. Arambula, Jonathan L.

Sessler,\* Jin Yong Lee,\* Sung-Gil Chi,\* and Jong Seung Kim.\* “Overcoming Drug Resistance by Targeting Cancer Bioenergetics with an Activatable Prodrug” *Chem-US*, **2018**, *4*, 2370–2383.

10. Hyeong Seok Kim,<sup>‡</sup> **Amit Sharma**,<sup>‡</sup> Wen Xiu Ren,<sup>‡</sup> Jiyou Han,\* and Jong Seung Kim.\* “COX-2 Inhibition Mediated Anti-angiogenic Activatable Prodrug Potentiates Cancer Therapy in Preclinical Model” *Biomaterials* **2018**, *185*, 63–72.
11. Ying Zhou<sup>‡</sup>, Mrinmoy Maiti<sup>‡</sup>, **Amit Sharma**<sup>‡</sup>, Miae Won, Le Yu, Lan Xi Miao, Jinwoo Shin, Arup Podder, Kondapa Naidu Bobba, Jiyou Han,\* Sankarprasad Bhuniy\* and Jong Seung Kim.\* “Azo-based Small Molecular Hypoxia Responsive Theranostic for Tumor-specific Imaging and Therapy” *J. Control. Release*, **2018**, *288*, 14–22.
12. **Amit Sharma**,<sup>‡</sup> Eun-Joong Kim,<sup>‡</sup> Hu Shi,<sup>‡</sup> Jin Yong Lee, Bong Geun Chung,\* and Jong Seung Kim.\* “Development of a Theranostic Prodrug by Combining Ligand-targeted Delivery and Enzyme-Stimulated Activation for Treatment of Colon Cancer.” *Biomaterials*, **2018**, *155*, 145–151.
13. Min Hee Lee,<sup>‡</sup> **Amit Sharma**,<sup>‡</sup> Min Jung Chang, Jinju Lee, Subin Son, Jonathan L. Sessler,\* Chulhun Kang,\* and Jong Seung Kim.\* “Fluorogenic Reaction-Based Prodrug Conjugates as Targeted Theranostics” *Chem Soc. Rev.*, **2018**, *47*, 28–52 (IF = 40.443; <sup>‡</sup> Equal Contribution), **(Back Journal Cover)**.
14. Eun-Joong Kim,<sup>‡</sup> Rajesh Kumar,<sup>‡</sup> **Amit Sharma**,<sup>‡</sup> Byungkwon Yoon, Hyun Min Kim, Hyunseung Lee, Kwan Soo Hong,\* and Jong Seung Kim.\* “In Vivo Imaging of  $\beta$ -Galactosidase Stimulated Activity in Hepatocellular Carcinoma using Ligand-Targeted Fluorescent Probe” *Biomaterials* **2017**, *122*, 83–99.
15. Kondapa Naidu Bobba,<sup>‡</sup> Anupama Binoy,<sup>‡</sup> Seyoung Koo,<sup>‡</sup> Divya Nedungadi, Arup Podder, **Amit Sharma**,\* Nandita Mishra,\* Jong Seung Kim,\* Sankarprasad Bhuniya.\* “Direct Readout Protonophore Induced Selective Uncoupling and Dysfunction of Individual Mitochondria within Cancer Cells” *Chem. Commun.* **2019**, *55*, 6429–6432.