List of **10 best papers** of the applicant highlighting the important discoveries/contributions described in them briefly:

1) **Rai A**, Liu T, Glauser S, Katrukha EA, Estévez-Gallego J, Rodríguez-García R, Fang WS, DíazJF, Steinmetz MO, Altmann KH, Kapitein LC, Moores CA, Akhmanova A. Taxanes convert regions of perturbed microtubule growth into rescue sites.

   Nature Materials. 2020 Mar;19(3):355-365. PubMed PMID: 31819210.

   Impact factor: 47.656

   Combining in vitro reconstitution assays with direct visualization of drug-microtubule interactions in real time using high-resolution microscopy, including single-molecule imaging. I made the surprising discovery that the extensively studied microtubule-stabilizing cancer drug **Taxol** can specifically bind to microtubule ends when microtubule growth is perturbed, stabilize these ends but prevent their closure into tubes. Microtubule polymers grown in the presence of Taxol thus contain stable "holes" in their regular lattice. An interesting therapeutically relevant implication of these findings is the unexpected cooperativity between microtubule destabilizing and stabilizing compounds in their ability to inhibit cancer cell growth.

2) **Rai A**, Liu T, Katrukha EA, Estévez-Gallego J, Paterson I, Díaz JF, Kapitein LC, Moores CA, Akhmanova A. Lattice defects induced by microtubule-stabilizing agents exert a long-range effect on microtubule growth by promoting catastrophes.

   Proc Natl Acad Sci U S A. 2021 Dec 21;118(51):e2112261118.

   Impact factor: 12.78

   Microtubule lattice defects induced by cancer drug Taxol and related drugs can exert effects that can propagate over long distances and affect the dynamic state of the microtubule end. This work provides how microtubule protofilament number varies within single microtubules. This work also fundamentally affects our thinking on how microtubule dynamics is regulated and helps to explain the enigmatic phenomenon of microtubule aging.

3) van Riel WE*, **Rai A***, Bianchi S, Katrukha EA, Liu Q, Heck AJ, Hoogenraad CC, Steinmetz MO, Kapitein LC, Akhmanova A. Kinesin-4 KIF21B is a potent microtubule pausing factor.

   Elife. 2017 Mar 14;6. pii: e24746. PubMed PMID: 28290984.

   ***equal first author. Impact factor: 8.713**

   This study revealed the function of kinesin KIF21B, a protein controlling microtubule networks in immune and neuronal cells. Using in vitro reconstitution based microtubule dynamic assays, I showed that the mammalian kinesin-4 KIF21B is a processive motor that can accumulate at microtubule plus ends and induce pausing. A few KIF21B molecules are sufficient to induce strong growth inhibition of a microtubule plus-end in vitro.

4) **Rai A**, Kapoor S, Naaz A, Kumar Santra M, Panda D. Enhanced stability of microtubules contributes in the development of colchicine resistance in MCF-7 cells. **Biochem Pharmacol. 2017** May 15;132:38-47. PubMed PMID: 28242250.

Impact factor: 6.1

I have developed a colchicine-resistant variant of MCF-7 cell line by the gradual increment of colchicine, which showed more than 8-fold resistance towards colchicine as compared to the parent MCF-7 cells. Time-lapse imaging of microtubules in live cells showed that the stability of individual microtubules in MCF-7Col30 cells increased as compared to the parent MCF-7 cells indicating that resistance was due to changes in the microtubule cytoskeleton

5) **Rai A**, Kapoor S, Singh S, Chatterji BP, Panda D. Transcription factor NF-κB associates with microtubules and stimulates apoptosis in response to suppression of microtubule dynamics in MCF-7 cells.

Biochem Pharmacol. 2015 Feb 1;93(3):277-89. PubMed PMID: 25536174.

Impact factor: 6.1

Using TN16, a known tubulin targeting agent, I have found that NF-κB interacts with microtubules in cells, and suppression of microtubule dynamics stimulates the NF- κB signaling cascade

6) **Rai A**, Gupta TK, Kini S, Kunwar A, Surolia A, Panda D. CXI-benzo-84 reversibly binds to tubulin at colchicine site and induces apoptosis in cancer cells.

Biochem Pharmacol. 2013 Aug 1;86(3):378-91. PubMed PMID: 23747346.

Impact factor: 6.1

Using cell-based screening approaches, potential anticancer agents CXI- benzo-84 *was* discovered using a large subset of benzimidazole derived scaffold as a starting point. Benzimidazole derivative CXI-benzo-84 displayed its anticancer activity by depolymerizing microtubules, inhibiting cell cycle progression in mitosis and accumulating spindle assembly checkpoint proteins at the kinetochores, which subsequently helped in activation of apoptotic cell death pathways in several types of cancer cells including highly metastatic and drug-resistant cells.

7) Gao L, Meiring JCM, Heise C, **Rai A**, Müller-Deku A, Akhmanova A, Thorn-Seshold J, Thorn- Seshold O. Photoswitchable epothilone-based microtubule stabilisers allow GFP-imaging- compatible, optical control over the microtubule cytoskeleton.

Angew Chem Int Ed Engl. 2021 2022 Mar 1;61(10):e202114614. PMID: 34902214

Impact factor: 16.82

This work can contribute greatly to high-precision research in cytoskeleton biophysics, cargo transport, cell motility, cell division, development, and neuroscience.

8) Peronne L, Denarier E, **Rai A**, Prudent R, Vernet A, Suzanne P, Ramirez-Rios S, Michallet S, Guidetti M, Vollaire J, Lucena-Agell D, Ribba AS, Josserand V, Coll JL,

Dallemagne P, Díaz JF, Oliva MÁ, Sadoul K, Akhmanova A, Andrieux A, Lafanechère L. Two Antagonistic Microtubule Targeting Drugs Act Synergistically to Kill Cancer Cells.

Cancers (Basel). 2020 Aug 6;12(8):E2196. PubMed PMID: 32781579.

Impact factor: 6.32

This work showed a new mechanism favoring cancer drug paclitaxel binding to dynamic microtubules can be transposed to in vivo mouse cancer treatments, paving the way for new therapeutic strategies combining low doses of microtubule targeting agents with opposite mechanisms of action.

9) Jost M, Chen Y, Gilbert LA, Horlbeck MA, Krenning L, Menchon G, **Rai A**, Cho MY, Stern JJ, Prota AE, Kampmann M, Akhmanova A, Steinmetz MO, Tanenbaum ME, Weissman JS. Combined CRISPRi/a-Based Chemical Genetic Screens Reveal that Rigosertib Is a Microtubule- Destabilizing Agent.

Mol Cell. 2017 Oct 5;68(1):210-223.e6. PubMed PMID: 28985505

Impact factor: 19.33

This work demonstrated the power of our chemical-genetic screening strategies for pinpointing the physiologically relevant targets of chemical agents.

10) Aher A, Kok M, Sharma A, **Rai A**, Olieric N, Rodriguez-Garcia R, Katrukha EA, Weinert T, Olieric V, Kapitein LC, Steinmetz MO, Dogterom M, Akhmanova A. CLASP Suppresses Microtubule Catastrophes through a Single TOG Domain.

Dev Cell. 2018 Jul 2;46(1):40-58.e8. PubMed PMID: 29937387.

Impact factor: 13.42

In this work we showed that cytoplasmic linker-associated proteins (CLASPs) suppress transitions from microtubule growth to shortening, termed catastrophes, including those induced by microtubule-destabilizing agents and physical barriers via single TOG2 domain.