List of ten best papers of the candidate, highlighting the important discoveries/contributions described in them briefly:

1. Anindyasundar Adak, Gaurav Das, Juhee Khan, Nabanita Mukherjee, Varsha Gupta, Rathnam Mallesh, **Surajit Ghosh.*** Extracellular Matrix Mimicking (ECM) Neuroprotective Injectable Sulfo-functionalized Peptide Hydrogel for Repairing Brain Injury. ***ACS Biomater. Sci. Eng. 2020, 6, 4, 2287-2296. Highlighted in Cover Page. (Impact Factor 4.749)***

   Brief Description: Brain injury can lead to the loss of neuronal functions and connections, along with damage of extracellular matrix (ECM). Thus, it ultimately results in devastating long-term damage and recovery of it is a challenging task. To address this issue, we have designed a sulfo group functionalised injectable biocompatible peptide hydrogel which not only mimic ECM and supports the damaged neurons but also it releases a neurotropic factor around the injured sites of brain in presence of Matrix Metalloproteinase 9 (MMP 9) enzyme. It has been also observed that the driving force of hydrogel formation is β-sheet secondary structure and π-π stacking interactions between the Phe-Phe moieties. The hydrogel is not only able to promote neurite outgrowth of PC-12 derived neurons and primary neurons cultured in presence of hydrogel, but also it is able to nullify the toxic effects of anti-NGF induced neurons. It also promotes the expression of the key neuronal markers in rat cortical primary neurons, displays substantial potential in neuroregeneration and also promotes fast recovery of the sham injured mice brain. Increase expression of reactive astrocytes in the hippocampal dentate gyrus region of the sham injured brain is clearly suggesting about its tremendous ability in neural repair of the damaged brain. Thus, we can convincingly state that our hydrogel is cable of repairing brain injury by mimicking ECM like environment and providing a neuroprotective effect towards the damaged neurons.

2. Surajit Barman, Gaurav Das, Varsha Gupta, Prasenjit Mondal, Krishnangsu Pradhan, Batakrishna Jana, Debmalya Bhunia, Juhee Khan, Deepshikha Mukherjee and **Surajit Ghosh.*** Dual Arm Nanocapsule Targets Neuropilin-1 Receptor and Microtubule: A Potential Nanomedicine Platform. ***Mol. Pharmaceutics 2019, 16, 2522-2531. (Impact Factor 4.9)***

   Brief Description: A multi-arm nanomedicine template has been designed following bottom-up approach, which target neuropolin-1 (Nrp-1) receptor of cancer cells. Through this venture we discovered that cucurbit [6] uril (CB [6]) binds with tubulin close to binding pocket of vinblastine site and perturbs tubulin polymerization. To increase the specificity of gold nanoparticle (GNP) towards Nrp-1 rich cancer cells, we further modified this GNP with Nrp-1 receptor specific short peptide (CGNKRTR). Remarkably, we found an interesting self-assembly process upon addition of curcumin into the CB [6] and peptide functionalized GNP leading to the formation of a spherical nanocapsule (CGNP·Cur). It can deliver and release significantly higher amounts of anticancer drug curcumin in Nrp-1 rich cancer cells. It causes microtubule depolymerization and significant tumor regression in Nrp-1 overexpressed mice melanoma model. These interesting finding shows that nanocapsule has high potential to develop a powerful anticancer nanomedicine and help in its preclinical validation.

3. Krishnangsu Pradhan, Gaurav Das, Varsha Gupta, Prasenjit Mondal, Surajit Barman, Juhee Khan, and **Surajit Ghosh.*** Discovery of Neuro-regenerative Peptoid from Amphibian Neuropeptide Inhibits Aβ Toxicity and Crossed Blood-Brain Barrier. ***ACS Chem Neurosci. 2019, 10, 3, 1355-1368. Highlighted in Cover Page. (Impact Factor: 4.48)***

Brief Description: Development of potential therapeutics for Alzheimer's disease (AD) required multifaceted strategy considering the high level of complexities of human brain and its mode of function. Here, we adopted an advanced strategy targeting two key pathological hallmarks of AD such as senile plaque and neurofibrillary tangles. We derived a lead short tetrapeptide Ser-Leu-Lys-Pro (SLKP) from dodeca-neuropeptide of amphibian (frog) brain. Results suggest that SLKP peptide has superior effect compared to the dodecapeptide in neuroprotection. This result encourages us to adopt peptidomimetic approach to synthesize SLKP peptoid. Remarkably, we found that SLKP peptoid is more potent than its peptide analogue, which significantly inhibits Aβ fibrillization, moderately binds with tubulin and promotes tubulin polymerization as well as stabilization of microtubule networks. Further, we found that SLKP peptoid is stable in serum, showed significant neuroprotection against Aβ mediated toxicity, promotes significant neurite outgrowth, maintains healthy morphology of rat primary cortical neurons and crosses the Blood-Brain Barrier (BBB). To the best of our knowledge, our SLKP peptoid is the first shortest peptoid showed significant neuroprotection, neuro-regeneration against Aβ toxicity as well as crossed the BBB offering a potential lead for AD therapeutics.

4. Juhee Khan, Gaurav Das, Varsha Gupta, Saswat Mohapatra, Subhajit Ghosh, and **Surajit Ghosh.*** Neurosphere Development from Hippocampal and Cortical Embryonic Mixed Primary Neuron Culture: A Potential Platform for Screening Neuro-Chemical Modulator. ***ACS Chem Neurosci. 2018, 9, 11, 2870-2878. Highlighted in Cover Page. (Impact Factor: 4.48)***

   Brief Description: Reconstitution of complex biological structure or system following simple and facile strategy using minimum physiochemical cues is challenging for in depth understanding of those systems. In particular, brain is a highly sophisticated and complex network of trillions of neurons and glial cells that controls function of our body. Understanding this complex machinery requires innovative and simple bottom-up approach. In this venture, we report an easy and efficient strategy to culture cortical and hippocampal primary neurons from the E14-E16 embryo of Sprague Dawley rat. This generates spontaneous neurospheres within 6-7 days of primary culture of E14-16 embryo. It further proliferates and forms radial glia like structures, which are known to be the primary neural progenitor cells that differentiate into neurons, astrocytes and oligodendrocytes. Interestingly, neurospheres leads to the formation of large projection neurons and radial glia, which mimic the early stage of cortical development in *in vivo* system. Overall, this new facile strategic mixed primary neuron culture method offers a potential platform for understanding the effect of neuro-chemical modulators, which has tremendous future implications in screening of neuro-therapeutics.

5. Prasenjit Mondal, Varsha Gupta, Gaurav Das, Krishnangsu Pradhan, Juhee Khan, Prabir Kumar Gharai and **Surajit Ghosh.*** Peptide-based Acetylcholinesterase Inhibitor Crosses Blood-Brain Barrier and Promotes Neuroprotection. ***ACS Chem Neurosci. 2018, 9, 2838-2848. (Article) (Impact Factor: 4.48)***

   Brief Description: Design and development of acetylcholinesterase (AChE) inhibitor has tremendous implications in the treatment of Alzheimer's disease (AD). Here, we have adopted a computational approach for designing of peptide based AChE inhibitor from its active site. We identified an octapeptide, which interacts with the catalytic anionic site (CAS) of AChE enzyme and inhibits its activity. Interestingly, this peptide also inhibits amyloid aggregation

through interacting at the 17-21 region of amyloid-beta (Aβ) and stabilizes microtubules by interacting with tubulin as well. Eventually in the PC12 derived neurons, it shows non-cytotoxicity, promotes neurite out-growth, stabilizes intracellular microtubules and confers significant neuroprotection even upon withdrawal of nerve growth factor (NGF). Further, results reveal that this peptide possesses excellent serum stability, crosses blood-brain barrier (BBB) and maintains the healthy architecture of the primary cortical neurons. This work shows a discovery of excellent peptide-based AChE inhibitor with additional potential as microtubule stabilizer, which will pave the way for the development of potential anti-AD therapeutics in near future.

6. Debmalya Bhunia, Prasenjit Mondal, Gaurav Das, Abhijit Saha, Pallabi Sengupta, Jagannath Jana, Saswat Mohapatra, Subhrangsu Chatterjee, and **Surajit Ghosh.*** Spatial Position Regulates Power of Tryptophan: Discovery of Major Groove Specific Nuclear Localizing Cell Penetrating Tetrapeptide. ***J Am Chem Soc., 2018, 140, 1697-1714. (Article) Selected for JACS Young Investigators Virtual Issue, 2019 by Prof. Peter J. Stang (Editor-in Chief, JACS). (Impact Factor: 15.41).***

   Brief Description: Identification of key amino acids is required for development of efficient cell penetrating peptides (CPPs) and has tre-mendous implications in medicine. Extensive research work enlightened us about the importance of two amino acids, arginine and tryptophan in the cell penetration. Here, we present a top-down approach to show how spatial positions of two tryptophans regulate the cellular entry and nuclear localization. This enables us to develop short nontoxic tetrapeptides with excellent potential of cell penetration and nuclear localization. Among them Glu-Thr-Trp-Trp (ETWW) emerges as most promising one. Result suggests that it enters into the cancer cell following endocytic path-way and binds at major groove of nuclear DNA, where successive tryptophan plays major role. Subsequently, we showed that it is not a P-gp substrate and nontoxic to PC12 derived neurons, suggesting its excellent potential as CPP. Fur-thermore, its potential as CPP has been validated in multi-cellular 3D cell culture (spheroid) and in in vivo mice model. This study provides major fundamental insights about the positional importance of tryptophan and opens new avenues towards the development of next generation CPP and major groove specific anticancer drugs.

7. Prasenjit Mondal, Gaurav Das, Juhee Khan, Krishnangsu Pradhan, and **Surajit Ghosh*** Crafting of Neuroprotective Octapeptide from Taxol-Binding Pocket of β-Tubulin. ***ACS Chem. Neurosci., 2018, 9, 615-625. (Impact Factor: 4.48)***

   Brief Decription: Microtubules play crucial role in maintaining the shape and function of neurons. During progression of Alzheimer's disease (AD), severe destabilization of microtubule occurs, which leads to the permanent disruption of signal transduction process and memory loss. Thus, microtubule stabilization is one of the key requirements for the treatment of AD. Taxol, a microtubule stabilizing anti-cancer drug has been considered as potential anti-AD drug, which was clinically unsuccessful due to its toxicity. Here, we adopted an innovative strategy for the development of peptide based microtubule stabilizer, considering the taxol binding pocket of β-tubulin and by using alanine scanning mutagenesis technique. This approach lead us to a potential octapeptide, which strongly binds with taxol pocket of β-tubulin, serves as an excellent microtubule stabilizer, Aβ aggregation inhibitor and neuroprotective agent. Further, results revealed that this peptide is non-toxic against both PC12 derived neurons as well as primary cortical neurons. We believe that our strategy and discovery of peptide-based

microtubule stabilizer will open the door for the development of potential anti-AD therapeutics in near future.

8. A Adak, G Das, S Barman, S Mohapatra, D Bhunia, **Surajit Ghosh.*** Biodegradable Neuro-Compatible Peptide Hydrogel Promotes Neurite Outgrowth, Shows Significant Neuroprotection, and Delivers Anti-Alzheimer Drug. ***ACS Appl Mater Interfaces. 2017, 9, 5067- 5076. (Impact Factor – 9.229)***

Brief Description: A novel neuro-compatible peptide based hydrogel has been designed and developed, which contains microtubule stabilizing and neuroprotective short peptide. This hydrogel shows strong three dimensional cross-linked fibrillary networks, which can capture water molecules. Interestingly, this hydrogel serves as excellent biocompatible soft-material for 2D and 3D (neuro-sphere) neuron cell culture and provides stability of key cytoskeleton filaments such as microtubule and actin. Remarkably, it was observed that this hydrogel slowly enzymatically degrades and releases neuroprotective peptide, which promotes neurite outgrowth of neuron cell as well as exhibits excellent neuroprotection against anti-NGF induced toxicity in neuron cells. Further, it can encapsulate anti-Alzheimer and anti-cancer hydrophobic drug curcumin, releases slowly and inhibit significantly the growth of 3D spheroid of neuron cancer cells. Thus, this novel neuroprotective hydrogel can be used for both neuronal cell transplantations for repairing brain damages as well as delivery vehicle for neuroprotective agents, anti-Alzheimer and anti-cancer molecules.

9. S Ghosh, S Mohapatra, A Thomas, D Bhunia, A Saha, G Das, B Jana, **Surajit Ghosh*** Apoferritin-nanocage delivers combination of microtubule and nucleus targeting anticancer drugs. ***ACS Appl. Mater. Interfaces, 2016, 8, 30824–30832. (Impact Factor: 9.229)***

Brief Description: An ideal nano drug delivery agent must be potent enough to carry high dose of therapeutics, competent enough in targeting specific cell of interest, having adequate optimized physiochemical properties and biocompatibility. Carrying differentially polar therapeutics simultaneously will make them superior in their class. However, it is of enormous challenge to the researchers to find out such a unique nanocarrier and engineer all the above-mentioned features into it. In this manuscript, we have shown for the first time that Apoferritin (Apf) can carry high dose of doxorubicin (Dox), docetaxel (Doc) and Dox-Doc simultaneously towards cancer cell specific targeting and enhanced killing compared to free drug without any functionalization or property modulation. On the other hand cytotoxicity of these Apf complexes is lesser than free drugs towards normal lung fibroblast cell (WI38). Drug loaded Apf specifically bound and consequently internalized into the cancer cells through receptor mediated endocytosis process and release either single or combination of drug to its specific target. Using molecular docking we have checked the binding efficacy of both the drugs. In addition, we have shown that Apf is non-cytotoxic in nature and binds with intracellular tubulin/microtubule. Further we have studied the efficacy of Apf complexes in 3D multicellular tumor spheroid model. Finally, using fluorescence microscopy we have shown that Apf can deliver combination of drugs inside cancer cells and the drugs exerts their effect thereof.

10. S Mohapatra, A Saha, P Mondal, B Jana, S Ghosh, A Biswas, **Surajit Ghosh*** Synergistic anticancer effect of peptide-docetaxel nano-assembly targeted to tubulin: Towards development of dual warhead containing nanomedicine. ***Adv Healthcare Mater., 2017, 6, 1600718. (Impact Factor: 9.93). Highlighted in Cover Page and Highlighted in Advance Science.***

Brief Description: Microtubule dynamics play a crucial role in cancer cell division. Various drugs are developed to target microtubule. Although a few of them show potential in treatment of cancer, but success rate is limited due to their poor bioavailability and lack of specificity. Thus, development of highly bioavailable and target specific anticancer drug is extremely necessary. To address these key issues, here, a combination of approaches such as development of a dodecapeptide-docetaxel nano-assembly targeted to tubulin and MUC1 targeting oligonucleotide aptamer conjugated liposome for delivering peptide-docetaxel nano-assembly into the breast cancer cell has been demonstrated. These studies reveal that the peptide forms nano-assembly and entraps docetaxel drug. Further, the liposomal formulation of peptide-docetaxel exerts synergistic anticancer effect, activates key mitotic check point proteins and inhibits bipolar spindle formation, metastatic cancer cell migration and growth of tumor mimicking 3D multicellular spheroid.