**Signed details of the excellence in research work for which the nomination is being sent (approximately 10 pages)**

**Scientific Contribution in Brief of Dr. Gautam Panda:**

Dr. Panda extensively, ingeniously harnessed chiral amino acids in synthesis of potent inhibitor of protein kinase C (-)-Balanol, antifungal antibiotic Ophiocordin, nicotinic agonists (+)-epiquinamide, (+)-α- conhydrine, antimitotic $C_3$-*epi*-(+)-lycoricidine, Jaspine B, potent inhibitor of glucosidase enzymes 8,8a-diepicastanospermine, (-)-Swainsonine, antibacterial levofloxacin, antimalarial (─)-Raphidecursinol B, spisulosine etc. Hetero [6-5-6] tricyclics resembling Taiwaniaquinoids and C-nor-D-homo steroids were synthesized through first heteroaromatic Nazarov type cyclization with excellent regioselectivity. His chiral serine azide through Weinreb amide to reduce acidity of α-proton is widely utilized. In quest for steroidomimetics, he envisages to employ Amino Acids to incorporate chiral space towards difficult asymmetric steroids. Thus, tyrosine-derived benzoxazine lead regressed tumor growth at 5mg/Kg and 20mg/Kg without causing any mortality in rat syngenic mammary tumor model. His work on spisulosine that markedly induces autophagic cell death to cancer cells is very interesting. His consistent effort has resulted in bringing **S006-830** with CFU count of $2.2 \times 10^7$ with comparable efficacies to ethambutol and PZA. He has published new effective routes for Cetirizine and bedaquiline like molecules and filed patents on new process routes of anticancer drugs Nintedanib and Olaparib. DCGI has given permission for two off-patented drugs (having no suppliers in India) like Almitrine and Ifenprodil based on his patented process route.

**Details of the Scientific Contributions of Prof. Dr. Gautam Panda**

The contribution of Dr. Gautam Panda spans several areas of contemporary interest in synthetic organic and medicinal chemistry. Dr. Panda works in close collaboration with experimental biologists, and has primarily chosen cancer and tuberculosis as his therapeutic targets. During his Ph.D. and post-doc, he worked on design and synthesis of bucky-bowls and heterogeneous catalysts respectively. However, later on, he has independently developed from a polyaromatic chemist to a medicinal chemist and elegantly utilized his training as an organic chemist to solve problems of biological interest. His contribution in amino acids (AA) derived pharmaceuticals (small molecules, natural products and steroidomimetics) offers an encouraging avenue for developing anti-cancer agents. Contribution in these three areas has been summarized in following reviews { Chemistry A European Journal; 2020, 26, 5131-5156; Tetrahedron 2013, 2853-2884, Tetrahedron 2017, 73, 1911-2008 (cover page), Eur J Org Chem 2014, 8004–8019, Org Biomol Chem., 2014, 6297-6339, ChemMedChem 2015;1467-1474, Bioorg & Med Chem 10.1016/j.bmc.2019.01.025 (cover page)}. Chirality derived from amino acids based architectures provide new and easy to incorporate chiral chemical space which otherwise very difficult to introduce and composed of several synthetic steps for asymmetric steroids. The ring A and D of steroidal architectures can be mimicked through amino acid tyrosine and proline. This idea was conceptualized by Dr. Panda and it has been executed (Bioorg Med Chem Lett, 2013, 23, 6816-6821, Bioorg Med Chem Lett 2010, 20, 283–287 (Top- 25 most cited articles" as published in BMCL (2010-2011), European Journal of Medicinal Chemistry 133 (2017) 139-151; Bioorg Med Chem Lett. 2018;28(4):778-782; Bioorganic & Medicinal Chemistry 25 (2017) 4452–4463, RSC Adv., 2013, 3, 19533-19544). One of the molecule (S-011-1559)

based on this idea is having significant anticancer activity in vivo and detailed biological evaluation is currently underway.

Amino Acids Derived Alkaloids as anticancer agents: Dr. Gautam Panda extensively, ingeniously harnessed chiral amino acids (AAs) in synthesis of potent inhibitor of protein kinase C (-)-Balanol, antifungal antibiotic Ophiocordin (Chem- Eur. J. 2008, 14, 4675-4688), nicotinic agonists (+)-epiquinamide, (+)-α- conhydrine (Tetrahedron, 2009, 65, 5322-5327), antimitotic C3-epi-(+)-lycoricidine (Tetrahedron Letters 2015, 56, 146-149), Jaspine B (RSC Adv., 2013, 3, 16795–16801), potent inhibitor of glucosidase enzymes 8,8a-diepicastanospermine, (-)-Swainsonine, L-altro-DNJ (Tetrahedron, 2014, 70, 1363-1374, RSC Adv., 2014, 4, 2161-2166), antibacterial levofloxacin (Tetrahedron Lett, 2009, 50, 4703-4705), novel antitumoral of marine origin spisulosine (Tetrahedron, 2010, 66, 9304-9309).

In the field of medicinal chemistry, a general consensus has emerged that library of molecules is not everything; library diversity, in terms of molecular structure and thus function, is crucial. Dr. Panda's Diversity-oriented synthesis (DOS) towards enantiomerically pure polycycles aims to generate such structural diversity in an efficient manner (J Comb Chem; 2007, 9, 321-338, ACS Comb Sci. 2012, 14(1):1-4). However, limited attention has been given to the synthesis of medium-ring chiral heterocycles. Dr. Panda's intramolecular Mitsunobu cyclization through the formation of carbon-oxygen, carbon-nitrogen and carbon-sulfur for the construction of seven and eight membered amino acids derived chiral heterocycles is a useful attempt in this direction (Tetrahedron letters 50 (33), 4703-4705; Organic and Biomolecular Chemistry, 2010, 8, 2823; Tetrahedron Letters, 2010, 51, 1483-1485). His concept of constructing seven membered chiral azepanes is widely used (Tetrahedron Lett, 2010, 51, 1483-1485). In the field of privileged chiral heterocycles, much effort has been directed toward the construction of unsaturated 1,4- benzodiazepines, but fewer methods exist for the synthesis of saturated chiral ones. Dr. Panda's convenient access to chiral benzodiazepines is an important contribution in this regard (J Comb Chem; 2007, 9, 321-338). His amino acids derived pyrrolobenzodiazepines (BZDs) as privileged scaffolds and difference of anti-ischemic activity due to enantiomers are quite interesting (Bioorg Med Chem Lett; 2007, 17, 1326-1331). Among the members of this family, Dr. Panda's synthesis of benzoxazocines was an added advantage (Bioorg Med Chem Lett 2010, 20, 244–247). Out of very few chiral syntheses of piperazines and morpholines, the approach developed by Panda et al. is promising (Chem Asian J 6 (1), 189-197, RSC Adv., 2013, 3 (40), 18332-18338). Dr Panda's attractive synthesis of chiral piperazine entity by ring opening of aziridines with amino acids followed by many researchers. (Org. Biomol. Chem. 2011, 9, 7365-7371). His one pot approach towards chiral morpholines from AA derived aziridines and glycidol via tandem aziridine/ epoxide ring opening offers easy evaluation and scale up of these series (World Drug Index reveals 100 drugs containing this core, Org. Biomol. Chem. 2011, 9, 7365-7371, Chem Asian J, 2011, 6, 189-197). Efficient routes for the enantioselective synthesis of bioactive 1, 2, 3, 4- tetrahydroquinoxalines are limited. Dr. Panda's Mitsunobu approach for the construction of this heterocycle is a useful contribution in this regard (Org Biomol Chem. 2012, 10(8):1553-64). Enantiomerically enriched indolines and tetrahydroisoquinolines were synthesized in high yields from easily accessible (S)-amino acid derived chiral carbocations. This Friedel–Crafts reaction is promoted by a Lewis acid ($AlCl_3$) offering trans diastereoselectivity which is significantly influenced by steric hindrance of the amino acid substituents and the nature of the aryl groups

(Org. Biomol. Chem, 2014, 11, 8318-24, Organic & Biomolecular Chemistry, 2017, 15, 1762 - 1766).

Catalytic chemistry of scandium [Sc(OTf)3] has recently been described to be quite attractive and fascinating and Dr. Panda elegantly used this reagent for the construction of conformationally constrained xanthenes as part of their ongoing program for the trisubstituted methanes as antitubercular agents (Org Biomol Chem, 2010, 8, 1097–1105). His protocol of conducting the domino reaction in an open vessel using catalytic Sc(OTf)3 for effective one pot synthesis of 9-unsubtituted xanthenes is interesting (Eur J Org Chem, 2009, 4757-4761). Spisulosine, first isolated from the clam Spisulosa polynyma that has entered clinical trials for the treatment of solid tumors and is a potent apoptotic inducer as a consequence of intracellular ceramide accumulation and PKCS activation. Dr. Panda has developed the first catalytic asymmetric and protecting group free synthesis of spisulosine. (Tetrahedron, 2010, 66, 9304-9309). Studies dealing with synthesis of 4a-substituted/unsubstituted tetrahydrofluorenes are scarce and no reports could be found with heteroatom impregnated tricyclic [6-5-6] skeleton either with or without 4a-substitution. Dr. Panda's work on construction of fused aromatic or heteroaromatic [6-5-6] or [6-5-5] tricycles with excellent diastereoselectivity has been mentioned as an elegant and efficient way to prepare substituted cyclopentenones with adjacent stereogenic centers using Nazarov 4π-conrotatory electrocyclization (Org Biomol Chem, 2009, 7, 1858-1867). Dr. Panda and co-workers expanded the scope of the reaction and delineated a catalytic version with triflic acid (Org. Biomol. Chem., 2011, 9, 4782-4790, cover page). Dr. Panda's elegant route for enantioselective construction of 2,3-dihydrobenzofuran core using phenolate ion mediated intramolecular ring opening of epoxides, finds mention by Barret et al. (Tetrahedron 2011, 67, 8731-8739) and Sheppard (J. Chem. Res. 2011, 7, 377-385), as this core is present in many bioactives demonstrating interesting biological properties. Dr. Panda's contribution towards enantioselective synthesis of benzo[b]oxepines via Phenoxide ion mediated 7-endo-tet carbocyclization of cyclic sulfates is noteworthy (Synthesis, 2009, 11, 1886-1896). His method of cyclization for oxaheterocycles from benzoxyl anion is also widely utilized (European Journal of Organic Chemistry, 2009, 204–207). In the landscape of reactivity and stability of oxiranes, his work on benzo-annulated oxa-heterocycles utilizing β-hydroxy-α-tosyloxy esters as chiral building blocks has been admired. (Tetrahedron, 2008, 64, 4162-4173).

His method to reduce the comparatively high acidic α-H atom of the serine methyl ester with respect to that of the serine amides has demonstrated (Synlett, 2004, 4, 714-716). Alcohol functionality of serine has been reported to undergo dehydrations, eliminations and rearrangement reactions under Mitsunobu conditions (Bård Helge Hoff; Tetrahedron 2010, 66, 6733-743, Anna Maria Papini et al., Eur. J. Org. Chem. 2008, 5308–5314). Dr. Panda used the Mitsunobu reaction of HN3 on N-protected L-serine derived Weinreb amides. The reason for the use of the Weinreb amide derivative was to reduce the acidity of the serine α-hydrogen and thus stop the formation of a dehydroalanine by a dehydration reaction as mentioned by Fintan Kelleher et al. (Tetrahedron Letters 2007, 48, 4879–4882).

His consistent effort has resulted in bringing green synthesis (Tetrahedron Letters, 2018, 59, 89-93, Tetrahedron 74, 2018, 6270-6277) of tri and tetrasubstituted methanes (TRSMs) with high potential towards developing antitubercular agents (Bioorg Med Chem Lett 18 (1), 289-292, Eur J Med Chem, 2015, 95, 357-368, RSC Adv., 2017, 7, 6966–6971, RSC Adv.,2014, 28317 – 28358;

ChemCatChem 2018, 10, 1941 – 1967; Tetrahedron 2018, 74, 4619-4703; RSC Adv., 2017, 7, 6966–6971, ACS Omega 2020, 5, 1, 19–30; New Journal of Chemistry, 2020, DOI: 10.1039/D0NJ01587C) and antimalarial agents (Free Radical Biology & Medicine, 2012, 53, 129-42, Eur. J. Org. Chem. 2010, 5100–5107, Antimicrobial Agents and Chemotherapy, 2008, 52, 705–715) respectively. His consistent effort has resulted in bringing tri and tetrasubstituted methanes (TRSMs) and Amino Acids derived steroidals and nonsteroidals towards developing potent antitubercular and anticancer agents respectively. Two molecules of his group (S-006-830 and S-011-1559) in these two areas respectively are quite promising. His recent work on spisulosine that markedly induces autophagic cell death to various cancer cells is very interesting (European Journal of Medicinal Chemistry, 2020, 188, 112011). Mild toxicity issues are being addressed by his group along with detailed biological evaluation. He has recently published new effective routes for Meclizine, Hydroxyzine and Cetirizine like drug molecules from base mediated 1,6- Aza-Michael addition of heterocyclic amines and amides to para-Quinone Methides chemistry (Synthesis 2019, 51, 4434-4442) and he found out new process routes for off-patent drugs like Almitrine and Ifenprodil which are currently at Phase III clinical trials for Covid-19 and can be scaled up (patent submitted). In the last twenty years of independent research, Dr. Panda has published 120 papers, which received around 2976 citations with h-index of 29 (https://scholar.google.co.in/citations?user=YwJvoiIAAAAJ&hl=en). He has guided 18 doctoral students and is inventor of seven patents. Many of his former doctoral students are holding academic and scientist position in research institutions and industries of India and abroad. He received Bronze medal from Chemical Research Society of India (CRSI) in 2012 and accepted JSPS invitation and Bridge fellowship from Japan and is member of evaluation committee for MEXT fellowships in Japan. He is a fellow of West Bengal Academy of Science & Technology (FAScT) and is a member of National Academy of Sciences, Allahabad (MNASc).

ChemCatChem 2018, 10, 1941 – 1967; Tetrahedron 2018, 74, 4619-4703; RSC Adv., 2017, 7, 6966–6971, ACS Omega 2020, 5, 1, 19–30; New Journal of Chemistry, 2020, DOI: 10.1039/D0NJ01587C) and antimalarial agents (Free Radical Biology & Medicine, 2012, 53, 129-42, Eur. J. Org. Chem. 2010, 5100–5107, Antimicrobial Agents and Chemotherapy, 2008, 52, 705–715) respectively. His consistent effort has resulted in bringing tri and tetrasubstituted methanes (TRSMs) and Amino Acids derived steroidals and nonsteroidals towards developing potent antitubercular and anticancer agents respectively. Two molecules of his group (S-006-830 and S-011-1559) in these two areas respectively are quite promising. His recent work on spisulosine that markedly induces autophagic cell death to various cancer cells is very interesting (European Journal of Medicinal Chemistry, 2020, 188, 112011). Mild toxicity issues are being addressed by his group along with detailed biological evaluation. He has recently published new effective routes for Meclizine, Hydroxyzine and Cetirizine like drug molecules from base mediated 1,6- Aza-Michael addition of heterocyclic amines and amides to para-Quinone Methides chemistry (Synthesis 2019, 51, 4434-4442) and he found out new process routes for off-patent drugs like Almitrine and Ifenprodil which are currently at Phase III clinical trials for Covid-19 and can be scaled up (patent submitted). In the last twenty years of independent research, Dr. Panda has published 120 papers, which received around 2976 citations with h-index of 29 (https://scholar.google.co.in/citations?user=YwJvoiIAAAAJ&hl=en). He has guided 18 doctoral students and is inventor of seven patents. Many of his former doctoral students are holding academic and scientist position in research institutions and industries of India and abroad. He received Bronze medal from Chemical Research Society of India (CRSI) in 2012 and accepted JSPS invitation and Bridge fellowship from Japan and is member of evaluation committee for MEXT fellowships in Japan. He is a fellow of West Bengal Academy of Science & Technology (FAScT) and is a member of National Academy of Sciences, Allahabad (MNASc).

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