CURRICULUM VITAE

1. **Name**: Prof. (Dr.) Santanu Paul
2. **Designation**: Professor and Head
3. **Specialization**: Cell Biology & Genetics; Biotechnology, Phytochemistry, Virology & Immunology.
4. **Passport size photograph**:

5. **Contact information**:

Department of Botany; Centre of Advanced Study;
35, Ballygunge Circular Road; Kolkata: 700019
email: spaul_1971@yahoo.com / spbot@caluniv.ac.in

6. Academic qualifications:

Year	College/ University from which the degree was obtained	Degree	Division
1993	Krishnath College (University of Calcutta)	B.Sc.	1st
1995	University of Calcutta	M.Sc.	1st
1996	Union Christian Training College; (University of Calcutta)	B.Ed.	1st
2003	Jadavpur University (Host Institute: CSIR-Indian Institute of Chemical Biology, Kolkata 700032)	Ph.D.	

7. **Positions held/ holding:**

a) Head: Department of Botany, University of Calcutta (September, 2024-till date)
b) Professor: Department of Botany; University of Calcutta (15th January, 2016 to till Date)

c) Associate Professor: Department of Botany; University of Calcutta (16th Sept, 2015 to 14th January, 2016)
d) Associate Professor: Department of Botany; Gurudas College; (15th January, 2013 to 15th September, 2015)
e) Assistant Professor: Department of Botany; Gurudas College; (15th January, 2001 to 14th January, 2013)

International position:

2004-2007 **Post Doctoral Fellow** at "Feinstein Institute for Medical Research" New York, **USA**.

Teaching Experience: 23 years and 11 months

Research Experience: 28 years and 11 months

Research Citations: 1485, **H - index:** 23 & **i10 index:** 42

Ph. D.: Awarded: **8**
Ongoing: **8**

Dissertation: 36

Publication summary:

a) Journals: ***80***

b) Books: ***3***

c) Book chapters: ***19***

d) Patents: ***3***

8. **Research interests**:

a. Bio-prospecting of medicinal plants for anti-cancer efficacy.
b. Studying the efficacy of Medicinal plants and Ayurvedic formulations for managing Diabetes and Leishmaniasis.
c. Mapping normal and cancer cell signaling networks: towards single-cell proteomics.

d. Studying the role of PI3K-AKT, mTOR, JAK/ STAT, Notch, and Wnt signaling pathways as a target for therapeutic intervention in various cancer types.
e. Understanding the role of Tregs in Cancer Stem Cell (CSCs) deregulation leading to leukemic transformations and focusing on the immuno-therapeutic outcome of its disease-resistant types related to such hyperactivations.

9. **Awards and Honors:**

2022 Recipient of **Sm. Subha Mukherjee Memorial Oration Lecture** for the contribution to the field of Cancer Biology by the Physiological Society of India.

2018 Recipient of "**Best Professor in Botany**" conducted by "26th Business School Affaire" and "Dewang Mehta National Education Awards - 2018" at Taj Bengal on 30th October 2018. Media Partner "ABP Ananda" and Banking Partner "YES Bank."

2017 Selected as **Editorial Board Member** of the AUSTIN LEUKEMIA Journal, USA.

2007 Selected as **Reviewer** of "Canadian Journal of Plant Science"

2006 Selected as an **Associate Member** of American Society for Hematology for *outstanding contribution in the field of Hematology*

2005 Recipient of **RESEARCH GRANT** for 2005 from *Lauri Strauss Leukemia Foundation*; NY (USA).

2000 "**YOUNG SCIENTIST AWARD**" for Biomedical Research In INDIA: Perspectives and Prospects.

10. **Research guidance**:

Number of researchers awarded Ph.D. degrees: **8**

- Dr. Priya K Gopal (Department of Biotechnology, CU)
- Dr. Swadesh Sarkar (Department of Botany, CU)
- Dr. Ankita Mridha (Department of Zoology, CU)
- Dr. Amrita Pal (Department of Botany, CU)
- Dr. Anirban Chouni (Department of Botany, CU)
- Dr. Ribhu Ray (Department of Botany, CU)

- Dr. Priyanka Mukherjee (Department of Botany, CU) Acted as Associate Supervisor.
- Dr. Susmita Das (Department of Botany, CU) Acted as Associate Supervisor.

Number of researchers pursuing Ph.D.: **8**

Dissertations: **36**

11. **Research Projects: 8**

a) **Title**: Telomere Reconstitution in Chronic Lymphocytic Leukemia.

PI: Santanu Paul **Agency**: Lauri Strauss Leukemia Foundation (**USA**)
Duration: 2005

b) **Title**: Biological evaluation of novel curcumin analogues as anti-leukemic agents and elucidating its molecular mechanism leading to apoptosis.

PI: Santanu Paul **Agency**: University Grants Commission.

Duration: 2008-2011

c) **Title**: Evaluation of plant crude extracts as potential anti-leukemic agent leading to chemical identification of the lead molecule and unraveling the molecular mechanism involved in apoptosis.

PI: Santanu Paul **Agency**: DST (WB) **Duration**: 2011-2014

d) Title: Isolation and purification sulfonoquinovosyldiacy-L glyceride (SQDG) from *Azadirachta indica* leaf for biological evaluation as potential anti-leukemic agent.

Co-PI: Santanu Paul **Agency**: ICMR (New Delhi) **Duration**: 2012-2015

e) **Title**: Screening for anti-leukemic activity of some wild edible mushrooms of India and unraveling the molecular mechanism involved in apoptosis.

PI: Santanu Paul **Agency**: UGC (New Delhi) **Duration**: 2013-2017

f) **Title**: Study of the anti-leukemic and anti-oxidant potential of some wild edible mushrooms of West Bengal: leading to chemical identification of the lead molecules.

PI: Santanu Paul **Agency**: Department of Biotechnology (W.B.)

Duration: 2014-2017

g) **Title:** "Screening of Anti- Leukemic and anti –oxidant potential of medicinal plants of Tripura: leading to chemical identification of lead molecules"

PI: Santanu Paul **Agency**: Department of Biotechnology; Government of India.

Duration: 2017-2020

h) **Title:** "Evaluation of anticancer and antioxidant potential of different Lichens available in North Bengal" **PI:** Santanu Paul

Agency: Department of Science and Technology; Govt. of West Bengal.

Duration: 2018-2022

12. **Select lists of publications**:

a) Journals: ***80***
b) Books: ***3***
c) Book chapters: ***19***
d) Patents: ***3***

a) ***Research articles in Journals:*** **80**

1. Nibedita Pyne, Ishita Bhattacharya and Santanu Paul. Garcinia cowa bark extract induces oxidative stress mediated cellular apoptosis in Leishmania donovani parasite modulated by its active phytosterol constituent. Journal of Asian Natural Products Research. (Taylor & Francis) (2024). Accepted.

2. Ishita Bhattacharya, Nibedita Pyne and Santanu Paul. In vitro and In silico Approaches Manifest the Anti-leishmanial Activity of Wild Edible Mushroom *Amanita princeps*. In Silico Pharmacology. (Springer) (2024). Accepted.

3. Debarupa Hajra, Anirban Chouni and Santanu Paul. Phytochemistry, antioxidant and anti-diabetic activities of *Sterculia villosa* in-vitro. Pharmacological Research-Modern Chinese Medicine (ELSEVIER). (2024) citescore:1.6. Accepted. https://doi.org/10.1016/j.prmcm.2024.100530

4. Rohit Kumar Dutta, Saparja Saha and Santanu Paul. In vitro experiments, LC-MS profiling, and in silico studies reveal anti-hepatocellular carcinoma properties of *Canna indica* L. Trends in Phytochemical Research (TPR). (2024) 8(3): 188-202.

5. Anwesha Mondal, Iman Dey, Aindri Mukherjee, Afrin Ismail, Gour Gopal Satpati, Sreemanti Banerjee, Santanu Paul, Soumitra Paul, Ruma Pal. Spirulina biomass loaded with iron nanoparticles: a novel biofertilizer for the growth and enrichment of iron content in rice plants. Biocatalysis and Agricultural Biotechnology. (ELSEVIER). (2024) Accepted. https://doi.org/10.1016/j.bcab.2024.103387

6. Saparja Saha, Ribhu Ray and Santanu Paul. Depside and depsidone-rich hydroalcoholic extract, resourced from the lichen *Parmelinella wallichiana* (Taylor) Elix & Hale selectively restricts Non-Small Cell Lung Cancer by modulating p53, FOXO1 and PALLADIN genes. Fitoterapia. (ELSEVIER). (2024) Accepted.

7. Suchismita Jha, Debarupa Hajra, Anirban Chouni and Santanu Paul. Novel triterpenoid, Schidigeragenin B enriched mother tincture of Conium maculatum: A promising future Antidiabetic drug. Pharmacological Research-Natural Products (ELSEVIER). (2024) Accepted. https://doi.org/10.1016/j.prenap.2024.100077

8. Nibedita Pyne, Ribhu Ray and Santanu Paul. Computational and experimental approaches manifest the leishmanicidal potential of α-mangostin resourced from *Garcinia cowa*. Acta Tropica (ELSEVIER). Accepted (2024). https://doi.org/10.1016/j.actatropica.2024.107291 **impact factor: 2.7**

9. Anwesha Mondal, Soumitra Paul, Ruma Pal and Santanu Paul. Nano iron loaded algal biomass: For better yield, amino acid and iron content in Rice – A 'Nano-Phycofertilizer'. Algal Research (ELSEVIER). Accepted (2024). https://doi.org/10.1016/j.algal.2024.103573 **impact factor: 5.1**

10. Ishita Bhattacharya and Santanu Paul. Mushroom and mushroom derived compounds in the management of leishmaniasis, A review. Research Journal of Biotechnology. Accepted (2024)

11. Ribhu Ray, Saparja Saha, Nibedita Pyne, Amrita Pal and Santanu Paul. Neoergosterol-rich mushroom extract, resourced from wild edible mushroom Termitomyces heimii Natarajan, induces robust apoptosis against lung cancer. South Africal Journal of Botany (ELSEVIER). 170: 229-249 (2024) https://doi.org/10.1016/j.sajb.2024.05.029 **impact factor: 3.1**

12. Debarupa Hajra, Anirban Chouni, Ribhu Ray and Santanu Paul. Neohesperidin, a flavanone glycoside resourced from *Curcuma amada* rhizome, holds the key to the remediation of Diabetes Mellitus: An integrated experimental and computational study. Pharmacological Research-Modern Chinese Medicine (ELSEVIER). DOI: https://doi.org/10.1016/j.prmcm.2024.100430 (2024) **citescore:1.6**

13. Anirban Chouni, Debarupa Hajra, Ribhu Ray and Santanu Paul. Bioactivity-guided isolation followed by network pharmacology and molecular docking reveals a novel polyphenolic xanthone, β-Mangostin from *Garcinia cowa* leaves as a potent compound against non-small cell lung cancer. Pharmacological Research-Modern Chinese Medicine (ELSEVIER). Accepted. DOI:10.1016/j.prmcm.2024.100367 (2024) **citescore:1.6**

14. Amrita Pal, Ribhu Ray, Anirban Chouni, Subhadip Hazra, Santanu Paul. Novel wild edible mushroom Astraeus hygrometricus induces robust apoptosis on human acute lymphoblastic leukemia cells through a RONS-subsisted mitochondria-dependent pathway. Journal of Traditional Chinese Medical Sciences (ELSEVIER). 11(1):67-77 (2024). DOI: https://doi.org/10.1016/j.jtcms.2023.12.008 **citescore: 1.9**

15. Sayanti Karmakar, Anirban Chouni, Amrita Pal and Santanu Paul. Assessment of the antioxidant and inhibitory property of leaf extract of Ricinus communis Linn. on proliferation against different human cancer cells. (2024). Research Journal of Biotechnology.

16. Shremayi Chatterjee, Nibedita Pyne and Santanu Paul. In silico screening of flavonoids unearthed Apigenin and Epigallocatechin Gallate, possessing antiviral potentiality against Delta and Omicron variants of SARS-CoV-2. The Nucleus (2023). Accepted. DOI: https://doi.org/10.1007/s13237-023-00431-9 **impact factor: 1.8**

17. Santanu Paul. Mushroom as new repository for small bioactive molecules for anticancer efficacy. Indian Journal of Physiology and Allied Sciences. 75(2): 76-79 (2023). DOI: 10.55184/ijpas.v75i02.09

18. Nibedita Pyne, Ishita Bhattacharya and Santanu Paul. Therapeutic Potential of Indian Medicinal Plants Against Leishmania donovani: A Review. Proceedings of the Indian National Science Academy. 89:1-14 (2023). DOI: 10.1007/s43538-023-00153-1 **impact factor:0.9**

19. Anirban Chouni and Santanu Paul. A comprehensive review of the phytochemical and pharmacological potential of an evergreen plant *Garcinia cowa*. Chemistry and Biodiversity. 20(2):1-14 (2023). DOI: 10.1002/cbdv.202200910
impact factor: 2.9

20. Saparja Saha, Ribhu Ray and Santanu Paul. In vitro screening and in silico docking analysis identifies two novel compound Lecanoric acid and Atranorin from Parmotrema tinctorum exhibiting potent anti-hepatocarcinoma activity. Biointerface Research in Applied Chemistry. 13(6): 1-21. 2023 DOI: 10.1002/cbdv.202200910 **cite score: 3.8**

21. Aranya Pal, Nibedita Pyne and Santanu Paul. In-Silico Designing of a Multi-Epitope Vaccine against SARS-CoV2 and Studying the Interaction of the Vaccine with Alpha, Beta, Delta and Omicron Variants of Concern. Current Drug Discoveries technologies. 20(1): 67-88, 2023. DOI: 10.2174/1570163819666220909114900.
Citescore:3.7; citation-0

22. Ribhu Ray, Saparja Saha and Santanu Paul. Two novel compounds ergosterol and ergosta-5,8-dien-3-ol from *Termitomyces heimii* Natarajan manifest promising anti-hepatocarcinoma activity. Journal of Traditional Chinese Medical Sciences. 9(4): 443-453 (2022). DOI: 10.1016/j.jtcms.2022.09.006.
Citescore:1.5; citations:2

23. Aaheli Chatterjee, Amrita Pal and Santanu Paul. A novel compound Plumercine from Plumeria alba exhibits promising anti-leukemic efficacies against B Cell Acute Lymphoblastic Leukemia. Nutrition and Cancer. 1,1-16 (2022). IF= 2.32 DOI: 10.1080/01635581.2021.2010777. **impact factor:2.81; citations:4**

24. Srija Mukherjee and Santanu Paul. In silico study identifies RO 28-2653 as a novel drug against SARS-CoV2 mutant strains. International Journal of Computational Biology and Drug Design. 14(6), 457-480 (2021). DOI: https://doi.org/10.1504/IJCBDD.2021.121622 **Citescore:0.9; citations:1**

25. Debadrita Paul, Nibedita Pyne, Santanu Paul. Mutation profile of SARS-CoV-2 spike protein and identification of potential multiple epitopes within spike protein for vaccine development against SARS-CoV-2, Virus Disease. 32, 703-726 (2021). DOI: https://doi.org/10.1007/s13337-021-00747-7. **Citescore:5.2; citations:14**

26. Amrita Pal, Ribhu Ray, Krishnendu Acharya, Santanu Paul. Assessment of the anti-leukemic and antioxidant potential of the methanol extract of a wild, edible, and novel mushroom, *Astraeus hygrometricus*, and unraveling its metabolomic profile, J. Adv. Biotechnol. Exp. Ther. 4 (2021) 388–404. DOI: https://doi.org/10.5455/jabet.2021.d138. **Cite score**:1.4; **citations**: 5

27. Nibedita Pyne and Santanu Paul. Screening of medicinal plants unraveled the leishmanicidal credibility of Garcinia cowa; highlighting Norcowanin, a novel anti-leishmanial phytochemical through an in-silico study, J. Parasit. Dis. (2021). DOI: https://doi.org/10.1007/s12639-021-01441-7. **Cite score**:2; **citations**: 10

28. Saparja Saha, Amrita Pal, Santanu Paul. A Review on Pharmacological, Anti-oxidant Activities and Phytochemical Constituents of a Novel Lichen *Parmotrema* Species, J. Biol. Act. Prod. from Nat. 11 (2021) 190–203. DOI: https://doi.org/10.1080/22311866.2021.1916596. **impact factor**:1.207; **citations**: 4

29. Anirban Chouni, Amrita Pal, Priya K Gopal, Santanu Paul. GC-MS analysis and screening of anti-proliferative potential of methanolic extract of Garcinia cowa on different cancer cell lines, Pharmacogn. J. 13 (2021) 347–361. DOI: https://doi.org/10.5530/pj.2021.13.45. **Cite score**:1.6; **citations**: 9

30. Ankita Mridha, Santanu Paul. Cladophora glomerata, a newly emerging green alga, acting as a repository of potent antioxidant, Res. J. Biotechnol. 16 (2021) 155–161. **impact score**:0.30; **citations**: 1

31. Pritha Chowdhury, Santanu Paul. The Potential Role of Mushrooms in The Prevention and Treatment of Diabetes: A Review, J. Biol. Act. Prod. from Nat. 10 (2020) 429–454. DOI: https://doi.org/10.1080/22311866.2020.1831958. **impact factor**:1.207; **citations**: 7

32. Ribhu Ray, Amrita Pal, Santanu Paul. Assessment of the Impact of Wild Stinkhorn Mushroom Extracts on Different Cancer Cell Proliferation and Study of Primary Metabolites. Pharmacogn Journal; 2020; 12(4): 699-708. IF = 0.82 DOI: 10.5530/pj.2020.12.102 **Cite score**:1.6; **citations**: 12

33. Ankita Mridha, Priya K Gopal, Santanu Paul. Screening Data Reveals that Spirogyra triplicata, a Fresh Water Algae Induces Robust Anti-Proliferative Activity Against A549 cells. Pharmacogn Journal; 2020; 12(3): 569-577. DOI: 10.5530/pj.2020.12.86 **Cite score: 1.6**; **citations**: 4

34. Swadesh Sarkar, Amrita Pal, Anirban Chouni, Santanu Paul. A novel compound βsitosterol-3-O-β-D-glucoside isolated from *Azadirachta indica* effectively induces apoptosis in leukemic cells by targeting G0/G1 populations. IJBB; 2020; 57(1): 27-32. Link: http://14.139.47.23/index.php/IJBB/article/viewFile/31770/465477424 **impact factor**:1.476; **citations**: 14

35. Amrita Pal, Anirban Chouni, Arpan Das, Ribhu Ray and Santanu Paul. Evaluation of Anti-proliferative Potential and Antioxidant Activity of a Wild Edible Mushroom Macrocybecrassa (Sacc.) Pegler and Lodge. Pharmacogn Journal; 2019; 11(6s):1504-1510. DOI: 10.5530/pj.2019.11.231 **cite score**:1.6; **citations**: 10

36. Swadesh Sarkar, Priya K. Gopal, Biswajit Chakraborty, Mausumi Paul, Chinmay Chowdhury, Santanu Paul. 14-Deoxy-11,12-Didehydroandrographolide: A Novel Compound Isolated from Andrographis paniculata Nees. Induces Robust Apoptosis in Leukemic Cells; Pharmacognosy Magazine: 2019:15S:135-143.IF = 1.52 DOI: 10.4103/pm.pm_466_18 **Impact Factor:** 1.5; **Citations:** 3

37. Suparna Laha, Santanu Paul. Costusigneus – A Therapeutic anti-diabetic herb with active phyto constituents; International Journal of Pharmaceutical Sciences and Research; 2019: 10(8): 3583-3591. DOI: 10.13040/IJPSR.0975-8232.10 (8).3583-91 **Citations:** 9

38. Moumita Dandapat, Santanu Paul. Secondary Metabolites from Lichen Usnea longissimaand its Pharmacological Relevance. Pharmacognosy Research; 2019;11:103-109. IF = 0.43 DOI: 10.4103/pr.pr_111_18 **Cite Score:** 2.6; **Citations:** 21

39. Suparna Laha, Santanu Paul. Gymnemasylvestre(Gurmar): A Potent Herb with Anti-Diabetic and Antioxidant Potential; Pharmacogn Journal; 2019;11(2):201-206. IF = 0.82 DOI: 10.5530/pj.2019.11.33 **Cite Score:** 1.9; **Citations:** 44

40. Saparja Saha, Santanu Paul. A review on phytochemical constituents and pharmacological properties of Enhydra fluctuansLour; Journal of Pharmacognosy and Phytochemistry; 2019; 8(2): 887-893. Link: http://www.phytojournal.com/archives/2019/vol8issue2/PartP/8-1-433-163.pdf **Citations:** 9

41. Debarupa Hajra, Santanu Paul. Study of Glucose-Uptake Enhancing Activity of Fenugreek (Trigonella foenum-graecum) Leaves Extract On 3T3-L1 Cell Lines and

Evaluation of Its Anti-Oxidant Potential. Pharmacognosy Research; 2018; 10(4), 347-353. IF = 0.43 DOI: 10.4103/pr.pr_50_18 **Cite Score:** 2.6; **Citations:** 14

42. Swadesh Sarkar, Priya Gopal, Santanu Paul. Andrographolide Induced Apoptosis in NALM-6 Cells Mediated Through the Cell Cycle Arrest and Nuclear Fragmentation. Pharmacognocy Journal; 2018: 10(2), 210-214. IF = 0.82
DOI : 10.5530/pj.2018.2.36 **Cite Score:** 1.9; **Citations:** 6

43. Anirban Chouni, Santanu Paul. A Review on Phytochemical and Pharmacological Potential of Alpinia galanga; Pharmacogn Journal; 2018; 10(1), 9–15. IF = 0.82
DOI: 10.5530/pj.2018.1.2. **Cite Score:** 1.9; **Citations:** 83

44. Tania Chakraborty, Santanu Paul. Glinusoppositifolius (L.) Aug. DC: A Repository of Medicinal potentiality. International Journal of Phytomedicine; 2017; 9:543557. IF = 1.2 Link: http://dx.doi.org/10.5138/09750185.2164 **Cite Score:** 0.6; **Citations:** 8

45. Swadesh Sarkar, Santanu Paul. Triptolide Mediated Amelioration of Breast Cancer via Modulation of Molecular Pathways; Pharmacognocy Journal; 2017; 9,6,838-845. IF = 0.82 DOI : 10.5530/pj.2017.6.131 **Cite Score**: 1.9; **Citations:** 5

46. Tania Chakraborty, Amrita Pal Basak, Ankita Mridha, Priya K Gopal, Santanu Paul. Anti-cancer and anti-oxidant potential of Indian carpet weed Glinus oppositifolius (L.) Aug. DC; Journal of Pharmacognocy and Phytochemistry; 2017; 6(5): 464-468.
Link: http://www.phytojournal.com/archives/2017/vol6issue5/PartG/6-4-372-265.pdf
Citations: 8

47. Sudeshna Saha, Santanu Paul. Potential of Hygrophila auriculata (Schumach.) Heine as a source of future anti-cancer drugs: A comprehensive review. Journal of Pharmacognosy and Phytochemistry. 2017; 6(4): 1725-1740.
Link: http://www.phytojournal.com/archives/2017/vol6issue4/PartY/6-4-206-335.pdf
Citations: 11

48. Ankita Mridha, Camellia Nandi, Ruma Pal, Santanu Paul. Studies on few fresh water green algal species reveals Spirogyra triplicataas the repository of high phenolic and flavonoid content exhibiting enhanced anti-oxidant property; 2017; 6(4): 1291-1297.
https://pdfs.semanticscholar.org/df82/661fc88b75b6e9768cff6e36261f75810309.pdf
Citations: 11

49. Ankita Mridha, Santanu Paul. Algae as potential repository of anticancer natural compounds. International Journal of Phytomedicine; 2017; 9:181-194.
DOI: http://dx.doi.org/10.5138/09750185.2023
Citations: 8

50. Dipannita Parial, Priya K. Gopal, Santanu Paul, Ruma Pal. Gold (III) bioreduction by cyanobacteria with special reference to in vitro biosafety assay of gold nanoparticles. Journal of Applied Phycology; 2016. IF = 2.6
DOI: 10.1007/s10811-016-0880-x
impact factor:3.4; **citations**: 30

51. Piya Roy Chaudhuri, Priya K Gopal, Santanu Paul, Ruma Pal. Cyanobacteria assisted biosynthesis of silver nanoparticles - a potential antileukemic agent. Journal of Applied Phycology; 2015 (Epub ahead of print) IF = 2.6
DOI: 10.1007/s10811-016-0852-1
impact factor:3.4; **citations**: 53

52. Brian A. McCarthy, Sophia Yancopoulos, Mike Tipping, Xiao-jie Yan, Xue Ping Wang, Fiona Bennett, Wentian Li, Martin Lesser, Santanu Paul, Erin Boyle, Carolina Moreno, Rosa Catera, Bradley T. Messmer, Giovanna Cutrona, Manlio Ferrarini, Jonathan E. Kolitz, Steven L. Allen, Kanti R. Rai, Andrew C. Rawstron, Nicholas Chiorazzi. A seven-gene expression panel distinguishing clonal expansions of pre-leukemic and chronic lymphocytic leukemia B cells from normal B lymphocytes. Immunologic Research. IF = 3.09. DOI: https://doi.org/10.1007/s12026-015-8688-3 **impact factor**:4.4; **citations**: 25

53. Sayantani Mukherjee, Priya K Gopal. Santanu Paul, Saurabh Das. Acetylation of 1,2,5,8- tetrahydroxy-9,10- anthraquinone improves binding to DNA and showed enhanced superoxide formation that explains better cytotoxicity on Jurkat T lymphocyte cells. Journal of Analytical Oncology. 2014; 3(3) 122-129.
DOI: https://doi.org/10.6000/1927-7229.2014.03.03.2 **citations**: 15

54. Swadesh Sarkar, Priya K Gopal, Santanu Paul. Diterpenoids: Potential Chemopreventive and Chemotherapeutic agents in Leukemia. Current Pharmaceutical. Biotechnology. 2014; 15:127-142
DOI: http://dx.doi.org/10.2174/1389201015666140604121658
impact factor:2.82; **citations**: 8

55. Priya K Gopal. Mausumi Paul, Santanu Paul. Role of different aberrant cell signaling pathways prevalent in Acute Lymphoblastic leukemia. Biolojia Journal. 2014; 69(9): 1097-1107 IF = 0.6 DOI: https://doi.org/10.2478/s11756-014-0428-y
impact factor:1.65; **citations**: 5

56. Tathagata Deb. Priya K Gopal, Durba Ganguly, Piyal Das, Manju Bikash Saha, Santanu Paul, Saurabh Das. Enhancement of anti-leukemic potential of 2-hydroxyphenyl azo-2- napthanol (HPAN) on MOLT-4 cells through conjugation with Cu (II). Royal Society of Chemistry Advances. 2014 (4); 18419-18430. DOI: https://doi.org/10.1039/C3RA44765K
impact factor:4.03; **citations**: 21

57. Priya K Gopal, Mausumi Paul, Santanu Paul. Anti leukemic potential of different Fenugreek seed germplasms. Am Jr Soc IssuHumn. 2014: 45-49.
Link:http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.678.2441&rep=rep1&type=pdf **citations**: 2

58. Priya K Gopal. Mausumi Paul, Santanu Paul. Curcumin induces caspase mediated apoptosis in JURKAT cells by disrupting the redox balance. Asian Pacific Journal of Cancer Prevention. 2014:15(1):93-100.
DOI:http://dx.doi.org/10.7314/APJCP.2014.15.1.93
Impact factor: 2.52**; Cite score**:3; **citations**: 54

59. Rajendra N. Damle, Sonal Temburni, Taraneh Banapour, Santanu Paul, Patricia K. A. Mongini, Steven L. Allen, Jonathan E. Kolitz, Kanti R. Rai, Nicholas Chiorazzi. T-cell independent, B-cell receptor-mediated induction of telomerase activity differs among IGHV mutation-based subgroups of chronic lymphocytic leukemia patients. Blood. 2012:120(12): 2438-2449. IF = 15.13
DOI: https://dx.doi.org/10.1182%2Fblood-2012-02-409110
impact factor:22.11; **citations**: 21

60. Acharya S. N., Acharya, K., Paul, S. Basu S. K.Antioxidant and antileukemic properties of selected fenugreek (Trigonellafoenum-graecum L.) genotypes grown in Western Canada. Canadian Journal of Plant Science. 2011: 91: 99-105. IF = 0.72
DOI: https://doi.org/10.4141/cjps10025 **Cite Score:** 1.8; **Citations:** 27

61. Piyal Das, Partha Sarathi Guin, Parikshit C. Mandal, Mausumi Paul, Santanu Paul, Saurabh Das.Cyclic voltammetric studies of 1,2,4-trihydroxy-9,10-anthraquinone, its interaction with calf thymus DNA and anti-leukemic activity on MOLT-4 cell lines: A Page 8 of 15 comparison with anthracycline anticancer drugs. Journal of Physical Organic Chemistry.2010, 23:1–12. IF = 1.6 DOI: 10.1002/poc.1827
impact factor:1.8

62. Ratna Chatterjee, Omkar Singh, Lalawmpuii Pachuau, Shiba Prasad Malik, Mausumi Paul, Kakali Bhadra, Santanu Paul, Gopinatha Suresh Kumar, NirupBikashMondal, Sukdeb Banerjee. Identification of a sulfoquinovosyldiacylglyceride from Azadirachtaindica and studies on its cytotoxic activity and DNA binding properties. Bioorganic and Medicinal Chemistry Letters. 2010; 20(22):6699-6702. DOI: 10.1016/j.bmcl.2010.09.007
impact factor:2.94; **citations**: 27

63. Brian A. McCarthy, Alluru S. Reddi, Kathleen M. Coakley, Steven M. Nguyen, Rasha R. Nayal, Mohammad Javdan, Santanu Paul, Norman Ende. Administration of Human Umbilical Cord Blood Cells Produces Interleukin-10 (IL-10) in IL-10 Deficient Mice without Immunosuppression. Curr Stem Cell Res Ther. 2010; 5(1):13-16. DOI: https://doi.org/10.2174/157488810790442868
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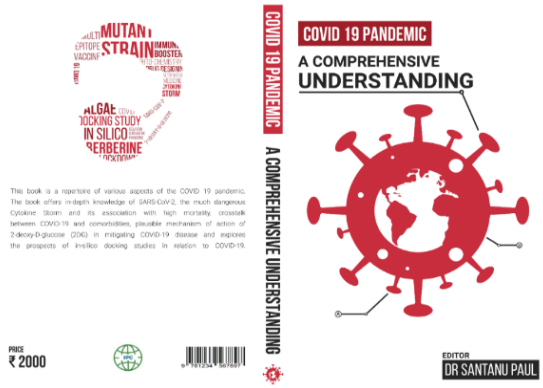
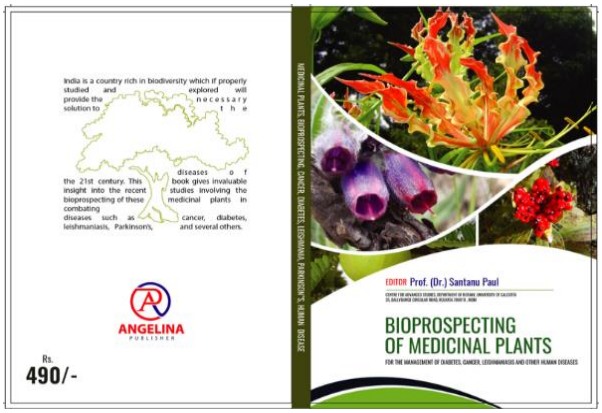
b) ***Books: 3***

Book 1: 2021: Covid 19 Pandemic: A comprehensive understanding. (Editor). Published by International Publishing Centre, Kolkata with USA ISBN No. 9781005151577

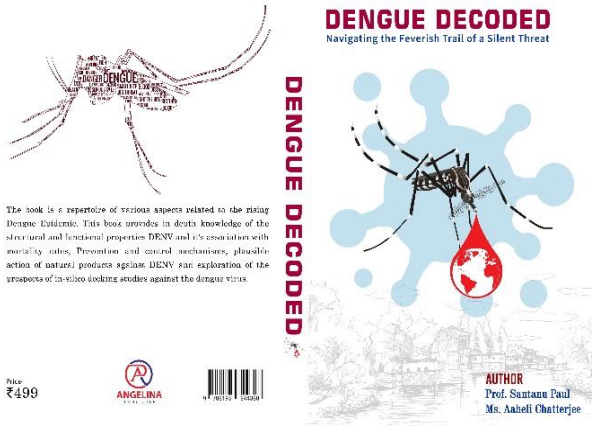


Book 2: 2022: Bioprospecting of Medicinal plants.
(Editor). Published by Angelina Publishers, Kolkata with ISBN 9788195844302



Book 3: 2024: Dengue Decoded Navigating the Feverish Trail of a Silent Threat.

Angelina Publishers, Kolkata with ISBN No. 9788195844388



c) ***Book chapters: 19***

1. Debarupa Hajra and Santanu Paul. **Ancient and Traditional Foods, Plants, Herbs and Spices used in Diabetes.** Medicinal Herbs and Spices in the Management of Diabetes.CRC Press (ISBN No. 9781003220930) Chapter 16; 2024:243-271. https://doi.org/10.1201/9781003220930
2. Ankita Mridha and Santanu Paul. **Natural resources for the prevention of gestational diabetes**. Bioprospecting of medicinal plants, for the management of diabetes, cancer, leishmaniasis and other human diseases. Angelina Publishers. (ISBN No. 9788195844302) Chapter 6; 2022: 113-120.
3. Ishita Bhattacharya and Santanu Paul. **A comprehensive study on secondary metabolites from medicinal plants in management of Leishmaniasis**. Bioprospecting of medicinal plants, for the management of diabetes, cancer, leishmaniasis and other human diseases. Angelina Publishers. (ISBN No. 9788195844302) Chapter 5; 2022: 85-112.
4. Bidisha Paul and Santanu Paul. **Cytokine storm and high mortality in COVID-19 patients.** Covid 19 Pandemic: A comprehensive understanding (ISBN No. 9781005151577) Chapter 2, 2021 (International Publishing Centre, Kolkata)
5. Debarupa Hajra and Santanu Paul. **Crosstalk between COVID-19 and comorbidities.** Covid 19 Pandemic: A comprehensive understanding (ISBN No. 9781005151577) Chapter 3, 2021 (International Publishing Centre, Kolkata)
6. Nibedita Pyne and Santanu Paul. **Prospects of *in silico* studies in relation to COVID-19**. Covid 19 Pandemic: A comprehensive understanding (ISBN No. 9781005151577) Chapter 4, 2021 (International Publishing Centre, Kolkata)

7. Srija Mukherjee and Santanu Paul. **A new insight to medicinal chemistry: docking study of repurposing drugs against SARS- COV2**. Covid 19 Pandemic: A comprehensive understanding (ISBN No. 9781005151577) Chapter 5, 2021 (International Publishing Centre, Kolkata)
8. Shremayi Chatterjee and Santanu Paul. **In-*silico* screening of Phytochemicals to combat COVID-19.** Covid 19 Pandemic: A comprehensive understanding (ISBN No. 9781005151577) Chapter 6, 2021 (International Publishing Centre, Kolkata)
9. Aranya Pal and Santanu Paul. **Epitope based vaccine construction-a new in silico strategy to combat COVID-19**. Covid 19 Pandemic: A comprehensive understanding (ISBN No. 9781005151577) Chapter 7, 2021 (International Publishing Centre, Kolkata)
10. Anirban Chouni and Santanu Paul. **Berberine as a potential therapeutic biomolecule for the treatment of COVID-19**. Covid 19 Pandemic: A comprehensive understanding (ISBN No. 9781005151577) Chapter 8, 2021 (International Publishing Centre, Kolkata)
11. Ribhu Ray and Santanu Paul. **The antiviral, anti-inflammatory natural mushrooms against SARS-CoV-2 infection**. Covid 19 Pandemic: A comprehensive understanding (ISBN No. 9781005151577) Chapter 9, 2021 (International Publishing Centre, Kolkata)
12. Ankita Mridha and Santanu Paul. **Algae as the potential treasure of COVID-19 treatment.** Covid 19 Pandemic: A comprehensive understanding (ISBN No. 9781005151577) Chapter 10, 2021 (International Publishing Centre, Kolkata)
13. Saparja Saha and Santanu Paul. **Plant metabolites: alternatives to synthetic drugs and hope for COVID-19**. Covid 19 Pandemic: A comprehensive understanding (ISBN No. 9781005151577) Chapter 11, 2021 (International Publishing Centre, Kolkata)
14. Debadrita Paul and Santanu Paul. **Insights into the plausible mechanism of action of 2-deoxy-D-glucose (2DG) in mitigating COVID-19 disease**. Covid 19 Pandemic: A comprehensive understanding (ISBN No. 9781005151577) Chapter 12, 2021 (International Publishing Centre, Kolkata)
15. Santanu Paul. **Diabetes during Pregnancy**. Eshana (ISBN No. 2349-0985); 98-101;2013.

16. Gopal P and Paul S. **Sustainable environmental technologies of the 21st Century**. 2011:20-22. Green Technology and Environment: Efforts for Building A Sustainable Planet. The Science Association of Bengal.
17. Acharya, S. N., Basu, S. K. Acharya, K, Paul, S., Datta Banik, S. and Prasad, R. Fenugreek: **A spice, forage and nutraceutical crop**. In: De. A. K. (edited) Spices: The elixir of life. Chapter 7; 2011:115-136.
18. Paul S, McCarthy B and Paul M. **Medicinal application of green tea and its polyphenolic catechins**. Advances in medicinal plant research. Chapter 11, 2007:237-256 (Research Sign Post Publishing Company; New Delhi)
19. Paul M and Paul S. **Bioplastics from microbes: A new approach towards sustainable environment**. Man and Environment. Chapter 14, 2007:229-236 (APH Publishing Corporations; New Delhi).

d) ***Conference/ seminar volumes***:

e) ***Other publications:***

13. **Membership of Learned Societies**:

- Associate Member of American Society of Hematology: USA
- Indian Society of Cell Biology; India
- The Cytometry Society-India
- Society of Hematological Oncology (SOHO): USA
- Probir Chatterjee Research Foundation
- Botanical Society of Bengal
- Physiological Society of India

14. **Patents: 3 (1USA, 1UK and 1 India patent)**

- Mandal C, Pal S, Chatterjee M, Bhattacharya DK. Process for the preparation of O-acetylated sialic acid specific immunoglobulin and method of quantification there of. 2000: **European Patent** no: 1083181 (filed on 01.19.2000 and Granted: 03/14/2001).

❖ Mandal C,Pal S, Chatterjee M, Bhattacharya DK. A process for the preparation of a novel biomarker specific for O-acetylated sialic acid useful for the diagnosis, monitoring outcome of treatment and prediction of relapse and biomarker prepared thereby; **Indian Patent** no: IN191209[Priority No: 1999DE000001192 filed on 8. 9.1999and Granted: 04/10/2003]

❖ Mandal C,Pal S, Chatterjee M. Process for preparation of a biomarker specific for O-acetylated sialic acid useful for diagnosing, monitoring treatment outcome, and predicting relapse of lymphoblastic leukemia. 2004; **US Patent** No: 6693177 (Granted:17/2/2004)

15. **Invited lectures delivered: 35**

Sl.No.	Title of Lecture/Academic Session presented	Title of Conference / Seminar/ Research Courses.	Organized by	International /National/ State
1	Impact of Green House Gases in the Environment.	Environment across the Globe: in light with Humanities and Sciences. 24th September, 2024	Maharaja Manindra Chandra College & Rashtra Bhasha Prachar Samity.	State
2	Exploration of Medicinal Plants as Potential Sources of Anti-cancer Drug Development	Lecture course organized by Dinhata College. 20th September, 2024	Department of Botany; Dinhata College	State
3	Nano iron loaded algal biomass for better yield and enhancement of amino acid and iron content in rice – A 'Nano-Phycofertilizer'	"Algal Biodiversity, Biotechnology and Environmental Sustainability" [NSABBES-2024] (20th August-21st August, 2024)	Berhampur University; Odisha	National

	formulation for high rice yield			
4	Unleashing Nature's pharmacy: an In-Depth Exploration of Medicinal Plants as Potential Sources of Anti-cancer Drug Development	International Faculty Development Program. (25th to 29th June, 2024)	Guru Nanak Institute of Pharmaceutical Science and Technology (GNIPST)	International
5	Exploration of Nano-iron loaded algae as Biofertilizer for Rice plant growth and iron content augmentation-a Lab to Land program for farmers.	National Seminar on-Environment and Sustainable Development-A Way of Self Sufficiency.	Dinhata College. Sponsored by Indian Council of Social Science Research. (15.03.2004-16.03.2024)	National
6	Bioactivity-guided isolation of lead bioactive molecules followed by network pharmacology and molecular docking reveals a novel polyphenolic xanthone, β-Mangostin from Garcinia cowa leaves as a potent compound against non-small cell lung cancer	Refresher Course (05.02.2024 to 18.02.2024)	UGC Approved Refresher Course on Recent Advance in Life Science for Sustainable Development. UGC MMTTC, Gauhati University. (06.02.2024)	National

7	Exploration of traditional knowledge for anti-cancer Drug Development.	7 Days Short-Term Course (STC) on Indian Traditional Knowledge	UGC Human Resource Development Centre (HRDC), University of Calcutta (22.01.2024)	National
8	Stems Cells and Umbilical Cord Banking	Short Term Course (STC) in Research Methodology in Social Science and Humanities	(20 UGC Human Resource Development Centre (HRDC), University of Calcutta (20.01.2024)	National
9	Exploring Nature's Pharmacy: Bioprospecting Strategies for anti-cancer Drug Development.	51st K.S. Rao Memorial Lecture	Department of Botany and Zoology, Vivekananda College, Thakurpukur. (15th Dec, 2023)	State
10	Lab to Land: Bridging the Gap	Algal Biotechnology: Scope for Research and Entrepreneurship Development.	Gurudas College (8-9th Dec, 2023)	State
11	Application of Flow Cytometry in Plant Sciences	Workshop on "Application of Flow Cytometry in Plant and Animal Sciences."	Department of Botany; University of Calcutta (15-17th Nov, 2023)	National

12	Drug Discovery	Department of Biotechnology sponsored Webinar on Drug Discovery	Department of Botany Lady Brabourne College (8th July 2023)	State
13	National Educational Policy 2020 and Curriculum and Credit Framework for Undergraduate Program.	NEP 2020	IQAC Cell; Vidyasagar College (16th June 2023)	State
14	Exploration of SARS Corona Virus and immunoinformatic approach for the construction of multi-epitope vaccines	Observance of International Biodiversity Day	THK Jain College (23rd May, 2023)	State
15	Exploration of novel phytochemicals in the amelioration of cancer therapy through bioactivity-guided isolation	One day State level seminar on "Chemistry behind Phytochemicals and their Medicinal Importance in curing various diseases of human being.	SA Jaipuria College and the Royal Society of Chemistry. (22nd May, 0223	State
16	Astrakarkurone, a novel sesquiterpenoid isolated from the wild edible mushroom *Astraeus hygrometricus* induces robust apoptosis on human acute	8th International Conference on Molecular Signaling and 4th CeSin Symposium	CSIR-Indian Institute of Chemical Biology. (16-18th March, 2023)	International

	lymphoblastic leukemia cells.			
17	Mushroom as new repository for bioactive small molecules for anti-cancer efficacy	**Sm. Subha Mukherjee Memorial Oration Lecture** RESEARCH AND TECHNOLOGICAL ADVANCEMENT IN HEALTH SCIENCES AND SUSTAINABLE DEVELOPMENT	Physiological Society of India and Department of Physiology. Vidyasagar University. (3-5th March, 2023)	International
18	Overview of SARS Corona Virus and Vaccine Development with Special Emphasis on Multiple Epitope Vaccine	Research and Development Cell, Lecture Series	Tripura University. (6th Feb, 2023)	State
19	Role of women scientists in solving global problems.	Sahitya, Samaj aur Bigyan ki shetra me rario ki Bhumika.	Maharaja Manindra Chandra College	National
20	Scientific achievement of INDIA Post Independence	75 Years of Independence	Paschimbanga Rashtra Bhasha Prachar Samity	National
21	Utilization of Immunoinformatic tools for designing multiple epitope vaccines against SARS-CoV2	Scientific achievement of INDIA Post Independence	Paschimbanga Rashtra Bhasha Prachar Samity	National
22	COVID-19 : Current Status and Prospects for Vaccine Development.	Refresher Course In Biological Science	North Bengal University. (17.09.2021)	National

23	Development of Science and Technology Post Independence. (स्वतंत्रता के बाद विज्ञान और प्रौद्योगिकी का विकास)	75th Indian Independence: A Research (in the Field of Literature, Science and History)	Maharaja Manindra Chandra College on the occasion of Hindi Day Celebration. (14.09.2021)	National Webinar
24	Advances in Biological Research	Coronavirus Disease (COVID-19): Current Status and Prospects for Vaccine Development	Lady Brabourne College (5th July, 2021)	National Webinar
25	COVID-19 pandemic and vaccination strategies	Covid 19 Pandemic and its impact on World Health.	Mahestala College on the occasion of World Health Day. (7th April, 2021)	National Webinar
25	COVID-19 pandemic and Comorbidity.	Impact of Covid on Literature and Science	Maharaja Manindra Chandra College on the occasion of Hindi Day Celebration. Organised by Hindi Department.	International Webinar
26	In search of a Vaccine for COVID 19	"Convergence of Biological and Medical Sciences"- a Ray of Sunshine in COVID pandemic 2020.	Organised by the Department of Microbiology and Chemistry, Muralidhar Girls College. 2nd August, 2020	International Webinar
27	Biodiversity: the Web of Life.	Biodiversity	On the occasion of the "World Environment Day", organized by Kolkata Nivedita Shakti.	National Webinar

			(5th June, 2020)	
28	ICT Integration in Teaching and Learning: Scopes and Challenges in Higher Education (Invited Talk)	One Day International Seminar on ICT Integration on Teaching and Learning : Scopes and Challenges in Higher Educational Institutions.	Muralidhar Girls College; Kolkata 700029 17th August, 2019	International
29	Anti leukemic and apoptotic potential of wild edible mushrooms of West Bengal: involvement of PI3/AKT pathway (Invited Talk)	XXVIth Annual National Conference of the Physiological Scoteity of India.	PHYSION-2014; Berhampore Girls College	National
30	Screening for anti-leukemic and apoptotic potential of wild edible mushrooms of West Bengal: involvement of PI3K/AKT pathway. (Invited Talk)	2nd International meet on Cell Signaling & Network (*CeSiN*).	CSIR-IICB; Kolkata 700032 2014	International
31	Panel development for multicolor Flow cytometry. 5th Annual meeting of the Cytometry Society, India and 13th INDO-US Cytometry (Invited Faculty)	Workshop on Application of Flow Cytometry; Kolkata, India. 12th-17th, October, 2012.	IPGMER and University of Calcutta 2012	International

32	Application of Flow Cytometry in Plant Sciences. (Invited Talk)	13th INDO-US Cytometry Workshop Application of Flow Cytometry in Nanotechnology and Plant Genomics.	Department of Biotechnology; IIT Guwahati, India. 8th – 10th October, 2012	International
33	Molecular mechanism of curcumin analogue-induced apoptosis in leukemia: involvement of PI3/AKT pathway. (Invited Talk)	1st International meet on Cell Signaling & Network (*CeSiN*).	11th – 13thSeptember,2012; CSIR-IICB;Kolkata.	International
34	Oxidative stress induced by novel curcumin analogue promotes apoptosis of leukemic cells by disrupting the PI3K/Akt signaling pathway. (Invited Talk)	Live organisms and there expressions in the environment	36th Annual Conference of Ethological Society of India; 26-28thNovember, 2012; University of Calcutta	National
35	Novel curcumin analogue as potent anti leukemic agent. (Invited Talk)	State Level UGC sponsored Seminar; Playing God: Expanding frontiers of Biotechnology.	Gurudas College, Kolkata, INDIA. 6-7th Nov, 2009,	State

16**. Resource person in Workshops:**

No.	Title of Workshop	Role played	Organised by	International/ National/State
1	Workshop on "Application of Flow Cytometry in Plant and Animal Sciences."	Convenor. Conducted Lab modules of plant and animal Flow Cytometry	Department of Botany; University of Calcutta	National
2	Workshop on Basic Cell Biology Technique.	Estimation of DNA by DPA method Estimation of RNA by orcinol method	Under Graduate Board of Studies (Botany) CU and Department of Botany, CU 25-26th November, 2022	State
3	2nd International meet on Cell Signaling & Network (*CeSiN*).	Multiparameter flow panel development in the identification of Leukemia sub types.	CSIR-IICB; Kolkata 700032 2014	International
4	13th INDO-US Cytometry Workshop Application of Flow Cytometry in Nanotechnology and Plant Genomics.	Determination of ploidy level in plants.	Department of Biotechnology; IIT Guwahati, India. 8th – 10th October, 2012	International

17. **Administrative Responsibilities:**

- Head; Department of Botany; University of Calcutta (September, 2024-till date)
- Deputy Registrar; University of Calcutta (Feb, 2018 to July 2018)
- Member, Ph.D. Research Advisory Committee, Department of BOTANY, CU (2021-2025)
- Member, PG Board of Studies, Department of BOTANY, University of Calcutta.
- Member, UG Board of Studies, Department of BOTANY, University of Calcutta.
- External Member, UG Board of Studies, BOTANY, Tripura University (2022-2025)
- External Member, UG Board of Studies, ENVIRONMENTAL SCIENCE, Tripura University (2022-2025)
- Ex Member, NEP Committee; University of Calcutta.
- Statute Committee member; Diamond Harbor Women's University.
- Member, Paschim Banga Ayurved Parishad; Govt. of West Bengal.

- ❖ Secretary, Organising Committee, 1st Botanical Science Congress; 23rd to 25th March, 2023
- ❖ University Nominee of the Governing Body of Bagnan College. (2023-2027)
- ❖ Ex-Head; Department of Botany; Gurudas College (2 years).
- ❖ Ex-Head; Department of Microbiology; Gurudas College (5 years).
- ❖ Convener of BOOST Program; Govt. of West Bengal at Gurudas College (2014-2015)
- ❖ Government Nominee of the Governing Body of Chittaranjan College. (2015-2022)
- ❖ University Nominee of the Governing Body of Mahestala College (2015-2019)
- ❖ University Nominee of the Governing Body of Muralidhar College. (2015-2019)
- ❖ University Nominee of the Governing Body of Kidderpore College. (2015-till date)
- ❖ University Nominee of the Governing Body of Netajinagar Night College. (2016-2022)
- ❖ University Nominee of the Governing Body of Matiaburj College; Kolkata 700024 (2018-Dec, 2022)
- ❖ West Bengal State Council of Higher Education Nominee of the Governing Body of Heramba Chandra College. (2018 – till date)
- ❖ Joint Convener; National Seminar on Biotechnology; 2009
- ❖ Teachers' Council Secretary; Gurudas College.
- ❖ NAAC Convener; Gurudas College.
- ❖ Joint Convener; International Conference on "Green Planet: Past, Present and Future" organized by Department of Botany; CU, 2016.

18. **Training Completed**:

- IACUC (Institutional Animal Care and Use Committee) training: for handling animals, at Feinstein Institute for Medical Research, NY, 11030 (2004)
- IRB (Institutional Review Board) training: for handling and working with human samples, at Feinstein Institute for Medical Research, NY, 11030 (2005)
- Radiation Safety Training: for use of radioactive materials in biological experiments, at Feinstein Institute for Medical Research, NY, 11030 (2006).