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A. Educational Qualification:

1. Ph. D. (Chemistry, Major-Biochemistry), 2012, University of Massachusetts, Lowell, MA, U.S.A. **Dissertation title:** Folding and Flexibility of Botulinum Neurotoxin Light Chain.

2. M.S (Chemistry, Major- Biochemistry), 2009, University of Massachusetts, Dartmouth, USA (2009).

3. M.Sc. (Chemistry, Major- Analytical Chemistry), 2001, Banaras Hindu University, Varanasi, India.

4. B.Sc. (H) (Physics, Chemistry, and Mathematics; Major- Chemistry), 1999, Banaras Hindu University, Varanasi, India.

B. Position Held:

1. **Kuruom School of Advanced Sciences (KSAS, a section 8 company), Lucknow, INDIA (December 2021 – Present):** Founder Director
    - Established KSAS as a registered non-profit organization by obtaining all necessary approvals and clearances from both local and central government authorities.
    - Spearheaded the development of a state-of-the-art research and education facility in India, overseeing all aspects of scientific and administrative operations.
    - Recruited and built a multidisciplinary team, including scientific researchers, humanity scientists, technical staff, and administrative personnel, to support the institution's mission.
    - Designed and implemented research and educational programs aligned with the organizational mission and vision, focusing on innovation, community impact, and scientific advancement.
    - Led the planning and architectural design of a second research facility in Indore, Madhya Pradesh, which is currently under construction.
    - Successfully commissioned a BSL-2 (Biosafety Level 2) laboratory at KSAS and initiated the process of establishing an Institutional Biosafety Committee (IBSC) in compliance with national biosafety regulations.
    - Achieved official recognition for KSAS by the Scientific and Research Organization, India, positioning the institution as a nationally acknowledged center for research and innovation.
2. **Institute of Advanced Sciences, Dartmouth (January 2021 – Present): Associate Professor**
    - Continued core responsibilities from previous role as Assistant Professor, including teaching, mentoring, curriculum development, and academic advising.

- Led the design and development of both accredited and non-accredited certificate and degree programs tailored to industry and academic standards.
- Initiated and structured institutional internship programs to enhance student employability and real-world experience.
- Spearheaded the development of an online teaching platform, enabling hybrid and remote learning capabilities for the institute.
- Played a key role in the establishment and expansion of research facilities to support advanced interdisciplinary studies.
- Facilitated collaborations with private sector entities and governmental agencies to promote joint research initiatives, funding opportunities, and academic-industry partnerships.
- Developed and executed outreach strategies to broaden the institute's impact through public engagement, research dissemination, and educational outreach programs.

3. **Institute of Advanced Sciences, Dartmouth (September 2018 – Present): Director of Research Program and Academic Advisement**

- Led the strategic development and implementation of teaching courses and specialized workshops to support academic excellence and professional development.
- Oversaw the design and execution of research programs, supporting faculty and student scholarship across disciplines.
- Curated and expanded the institute's research portfolio, aligning projects with institutional priorities and emerging scientific trends.
- Managed and supported the development of intellectual property, including invention disclosures, patents, and licensing opportunities.
- Initiated and cultivated research collaborations with academic institutions, industry partners, and government agencies to advance joint research projects.
- Promoted a culture of research integrity and innovation through policy development, capacity building, and external engagement.

3. Institute of Advanced Sciences, Dartmouth (March 2014 – December 2020): Assistant Professor

- Conduct advanced R&D in protein chemistry, diagnostics, drug screening and delivery, cell culture, nanoparticles, and biotechnology.
- Specialized in isolation and purification of native and recombinant proteins, followed by biochemical and biophysical characterization.
- Applied structural analysis techniques including UV/VIS spectrophotometry, fluorescence spectroscopy, circular dichroism, and fluorescence microscopy.
- Led development of therapeutic strategies and antidotes against botulinum neurotoxins; extracted and screened bioactive compounds from plants and synthetic sources.
- Designed and conducted enzyme inhibition assays and neurotoxicity tests using neuroblastoma cells and enteric neurons.
- Developed ELISA protocols for detection of pathogenic compounds and contributed to vaccine candidate characterization against tetanus and botulinum toxins.
- Coordinated multi-institutional research collaborations with federal agencies and corporate laboratories.
- Managed research data and analysis using Laboratory Information Management Systems (LIMS); ensured regulatory compliance in all research activities.

- Authored and submitted grant proposals to major funding agencies including NIH and DoD; provided regular progress reports to the institute's President.
- Active member of IACUC (Institutional Animal Care and Use Committee) and IBC (Institutional Biosafety Committee), ensuring ethical and biosafe research practices.

4. **Chemistry and Biochemistry Department, UMASS Dartmouth (January 2012 -December 2014):** As a part-time lecturer.
5. **Centre of Indic Studies, UMASS DARTMOUTH (February 2012 - May 2014):** Research Associate, responsible for writing grant proposals, experimentation, presentation, and assisting graduate and undergraduate students.
6. **Botulinum Research Center (January 2012 - August 2013):** Research Associate, responsible for writing grant proposals, experimentation, presentation, and assisting graduate and undergraduate students.
7. **Botulinum Research Center, UMASS DARTMOUTH (September 2007 - December 2011):** As a graduate student pursued my PhD work.
8. **Advinus Therapeutics, Pune, INDIA (A member of TATA group) (February 2006 - July 2007):** Analytical Scientist
   - Conducted purification of organic compounds using mass-based purification techniques to support early-phase drug discovery efforts.
   - Performed qualitative and quantitative analysis of chemical entities to ensure purity, integrity, and compliance with experimental protocols.
   - Carried out detailed characterization of compounds using advanced analytical techniques, contributing to lead optimization and compound library development.
   - Collaborated closely with medicinal chemists and project teams to accelerate compound screening and candidate selection.
   - Maintained meticulous records of analytical data and experimental procedures in accordance with GLP standards and regulatory requirements.
9. **Regent Drugs Limited, INDIA (A member of TEVA group) (January 2004 - February 2006):** Research Assistant Scientist
   - Led and managed three independent research and development projects from initiation through completion, including literature review, method development, validation, and product stability studies.
   - Oversaw the full lifecycle of analytical method development and validation in compliance with regulatory standards.
   - Coordinated daily activities, task assignments, and timelines for cross-functional team members to ensure efficient workflow and project milestones.
   - Presented project progress, technical data, and outcomes in internal and external meetings, effectively communicating with stakeholders and collaborators.
   - Ensured documentation accuracy, data integrity, and adherence to quality assurance protocols throughout all phases of the projects.
10. **LUPIN Research Park, Pune, INDIA (June 2001 - January 2004):**
   - Progressed from Trainee to Research Scientist (E-II) within three years, demonstrating strong technical proficiency, leadership, and initiative.
   - As Trainee: Performed routine analysis of pharmaceutical compounds, supporting daily lab operations and data documentation.

- As Assistant Research Scientist (E-I): Conducted qualitative and quantitative analysis, developed analytical methods, and supported routine testing for R&D samples.
- As Research Scientist (E-II): Led analytical method development, validation, and stability studies; ensured accuracy and regulatory compliance across all phases.
- Planned and scheduled work for the project team; prepared comprehensive project reports and communicated outcomes with cross-functional departments.
- Successfully executed analytical method transfers to the Quality Control (QC) department and led several pilot-scale projects.
- Maintained high standards of data integrity, GMP/GLP compliance, and effective collaboration with QA, QC, and formulation teams.

C. Scholarships, Awards and Positions:

1. Best participant award in Chemistry Quiz held at Mrs. K.M.P.M School, Jamshedpur, India, 1995.

2. Successfully completed summer internship at Tata Steel, Jamshedpur, India, 2000.

3. Second Prize in Quiz held at Advinus Therapeutics (A Member of TATA group), 2006.

4. Graduate Assistant, Botulinum Research Center, UMASS, Dartmouth, September - December 2007.

5. Shaukat Ali Memorial Scholarship, 2008, UMASS, Dartmouth.

6. Research Assistant, Botulinum Research Centre, UMASS, Dartmouth, January 2008 - December 2009, August - December 2010.

7. Teaching Assistant, Chemistry and Biochemistry Department, UMASS, Dartmouth, January-May 2010.

8. Teaching Assistant, Chemistry and Biochemistry Department, UMASS, Dartmouth from Jan. 2011 to May 2011.

9. Teaching Fellow at Chemistry and Biochemistry Department, UMASS, Dartmouth from Sept. 2011 to Dec. 2011.

10. Awarded Dissertation Writing Support Grant from UMASS, Dartmouth, Fall 2011.

11. Chair, IBSC, Gufic Biosciences, Jan 2019 – May 2024.

12. Selected for National Institute of Health (NIH, USA) – ECR program, 2021.

13. Selected for National Institute of Health (NIH, USA) - SuRE program 2023.

14. Selected for Editorial Board of Frontiers in molecular Biosciences (2023 – present).

15. Outside expert, INSC, Gufic Biosciences, (March 2025 – Present).

D. Research projects.

In all the listed projects, currently I am working as a Principal Investigator.

1. Structure and Function of Protein:

- Leading multiple projects investigating the structure-function relationships of proteins, with Botulinum Neurotoxin (BoNT) and its various domains serving as model systems.
- Utilized both conventional biophysical techniques (UV-Vis spectroscopy, fluorescence spectroscopy, circular dichroism) and advanced methods (Small-Angle X-ray Scattering [SAXS], computational modeling) to study protein folding, flexibility, and functional mechanisms.
- Collaborated with Dr. Valeri Barsegov (University of Massachusetts, Lowell), a recognized expert in computational biophysics, to integrate simulation data with experimental results.
- Addressing fundamental questions in protein science, including:
  - What determines the kinetic efficiency differences between similar proteins?
  - What structural elements contribute to enhanced protein stability?
  - How do structural intermediates influence protein function and mechanism of action?
- Outcomes of this research aim to inform rational protein design and therapeutic interventions targeting neurotoxic proteins.

2. Cellular Projects:

- Developed standardized protocols for the differentiation of stem cells into functional neurons to support neurobiology research and therapeutic screening.
- Designed and implemented a novel technology aimed at enhancing the bioavailability of therapeutic molecules through improved intestinal absorption.
- Established a cell-based potency assay for evaluating the biological activity of Botulinum neurotoxin, contributing to quality control and therapeutic validation.
- Conducted experimental studies on apoptosis inhibition to explore mechanisms of cell survival and potential applications in neuroprotection and drug development.
- Integrated cross-disciplinary approaches, including stem cell biology, neuropharmacology, and cellular assay development, to advance translational research objectives.

3. Targeted drug delivery:

- Leading three major research projects focused on the development of advanced drug delivery systems targeting specific tissues and cell types:
  - *Topical Delivery:* Formulating and optimizing therapeutic compounds for effective transdermal or localized skin delivery.
  - *Neuronal Delivery:* Developing strategies for targeted delivery of neuroactive agents across the blood-brain barrier to neuronal cells.

Targeted Cancer Delivery: Engineering delivery systems that selectively target cancerous cells, enhancing therapeutic specificity while minimizing off-target effects.

- Applying a multidisciplinary approach integrating nanotechnology, formulation science, and cellular biology to improve therapeutic efficacy and precision.
- Aiming to enhance bioavailability, reduce systemic toxicity, and improve patient outcomes across various therapeutic applications.

4. Protein purification, stability and functional studies:

- Conducting in-depth studies on the translocation mechanisms of Botulinum Neurotoxins (BoNT), with a focus on understanding domain-specific roles in cellular entry and activity.
- Purifying and characterizing chimeric proteins and recombinant P80, as well as isolating native proteins to support functional and structural analysis.
- Investigating the stability of BoNT/A in various formulations to inform the development of more effective and stable therapeutic preparations.
- Performing mammalian cell transfection and protein expression, supporting functional assays and mechanistic studies in a controlled cellular environment.
- Evaluating the efficacy of the M-complex of BoNT/E through in vitro and in vivo models, assessing both potency and safety for potential therapeutic use.
- Applying a combination of biochemical, molecular biology, and pharmacological techniques to advance understanding of neurotoxin biology and therapeutic application.

5. *Neuronal regeneration project:*

- Leading two parallel research projects aimed at advancing neurological repair and functional recovery:

  Axonal Regeneration: Investigating molecular and cellular mechanisms to promote axonal growth and nerve regeneration following injury or neurodegeneration.

  Synaptic Plasticity Enhancement: Exploring strategies to improve synaptic strength and adaptability, with implications for learning, memory, and neurorehabilitation.

  Delivery systems: Identifying and exploring strategies to improve delivery of genetic molecules of therapeutic values to Adeno associated virus, lentivirus and botulinum toxin-based delivery system.
- Utilizing advanced in vitro and in vivo models to study neuronal growth, synaptic transmission, and plasticity-related biomarkers.
- Partially funded by the National Institutes of Health (NIH)**,** supporting the translational potential of these studies in neurotherapeutics and regenerative medicine.
- Aiming to develop therapeutic approaches for neurodegenerative diseases, spinal cord injury, and cognitive dysfunction by targeting neural repair pathways.

6. *Oncology project:*

- Investigating the mechanisms and therapeutic strategies for treating neural crest cell-derived tumors through a holistic, multipronged approach.
- Focusing on epigenetic reprogramming of tumor cells as a novel strategy to reverse malignancy and overcome resistance associated with traditional therapies.
- Challenging the conventional “one drug–one target” paradigm by developing single-treatment approaches that address multiple mechanistic aspects of cancer simultaneously.

- Collaborated with Dr. Chandra Sekhar Mayanil (Northwestern University) to explore translational potential and extend findings to other cancer models.
- Currently expanding this research to additional tumor types and working on the development of innovative cellular engineering methods aimed at creating next-generation cancer therapies.
- Integrating molecular biology, genomics, and therapeutic design to establish novel, adaptable platforms for targeted and durable cancer treatment.

7. *Inhibitor Designing*:

- Contributed to a multidisciplinary project focused on identifying and characterizing inhibitors of Botulinum Neurotoxin (BoNT) using a combination of conventional screening techniques, molecular dynamics (MD) simulations, and ex vivo assays**.**
- Employed in silico modeling and structure-based drug design to predict binding affinities and optimize potential inhibitor candidates.
- Conducted biological efficacy testing of shortlisted compounds using ex vivo systems to evaluate functional inhibition and therapeutic relevance.
- Project funded by the U.S. Department of Defense (DoD) and Infinity Foundation, USA**,** supporting national biodefense and public health preparedness initiatives.
- Collaborated with interdisciplinary teams integrating computational chemistry, pharmacology, and toxicology to advance lead candidate development.

8. *Biosensor development:*

- Contributed to the design and model development of a novel detection instrument utilizing fluorescence anisotropy as a core analytical principle.
- Involved in conceptualization, functional modeling, and optimization of system parameters for sensitive and specific detection of target analytes.

9. *Alternate theory of evolution:*

- Engaged in the development of an alternative theory of evolution grounded in molecular characteristics, aiming to complement or reframe existing Darwinian and neo-Darwinian paradigms.
- Focused on exploring molecular determinants—such as protein structure-function relationships, genetic network dynamics, and biochemical constraints—as drivers of evolutionary change.
- Authored and published multiple theoretical papers**,** contributing to the discourse on evolutionary biology from a molecular and systems-level perspective.
- Research seeks to provide a holistic, mechanistic explanation of evolutionary processes, integrating insights from molecular biology, biophysics, and complexity theory.

10. Immune response project:

- Participating in an early-stage research project hypothesizing that BoNT/A may influence CD4+ and CD8+ T-cell activity**,** potentially affecting immune modulation.
- Engaged in the conceptual and experimental design phase, including hypothesis formulation, preliminary data analysis, and planning of validation experiments.

- Part of the INADS collaboration with Dr. Manoj Bhasin at Beth Israel Deaconess Medical Center, Boston, MA (Harvard Medical School affiliate).
- Aiming to uncover novel neuro-immune interactions that could have implications for both therapeutic use of BoNT and understanding its broader biological impact.

11. Development of pain model:

- Contributed to the development of an engineered 3D microfluidic device designed to model the tripartite structure of the brain**,** incorporating neuronal, astrocytic, and microglial components.
- Focused on the optimization of the BoNT/A-induced acetylcholine release assay, ensuring accurate measurement of neurotransmitter activity within the model.
- Performed treatment and analysis of the brain model with Botulinum Neurotoxin A (BoNT/A) to study its effects on synaptic transmission and cellular interactions.
- Project aims to provide a physiologically relevant in vitro platform for neurotoxicity screening, disease modeling, and therapeutic testing in a controlled microenvironment.

12. BoNT/A product development projects:

- Played a key role in the initial planning and strategic discussions for the development of multiple products derived from Botulinum Neurotoxin (BoNT).
- Led project management activities, including timeline planning, coordination of multidisciplinary teams, and milestone tracking.
- Developed and executed research protocols, contributing to product formulation, validation strategies, and feasibility assessment.
- Prepared comprehensive technical and regulatory documents for internal review and external communication.
- Participated in multiple stakeholder meetings, representing the scientific team in discussions with interested organizations and potential collaborators.
- Contributed to the project's progression from conceptual stage to actionable development plans, supporting translational and commercial potential.

13. Topical formulation of BoNT/A:

- Developed topical formulations for localized delivery of therapeutic agents, focusing on enhanced skin permeability and targeted efficacy.
- Designed, optimized, and trained personnel on the execution of the toe-spread assay, a functional animal model for evaluating neuromuscular effects.
- Conducted animal studies at four different dose concentrations (100, 50, 25, and 10 units), yielding promising results in terms of efficacy and safety.
- Led the protocol development, optimization, and execution of experiments for hyperhidrosis treatment and Franz cell diffusion assays to assess dermal drug permeation.
- Managed full experimental workflows from design through data collection, analysis, and reporting, contributing to both preclinical evaluation and regulatory readiness.

14. COVID vaccine:

- Designed the mammalian expression construct for the TC2 vaccine, ensuring optimal codon usage and regulatory elements for high-yield expression.

- Developed and optimized protocols for expression and purification of the TC2 vaccine in mammalian cell systems.
- Successfully engineered and stabilized a high-yield production clone, enabling cost-effective and scalable vaccine manufacturing.
- Oversaw the full technology development pipeline, from molecular design through to pilot-scale production.
- Prepared comprehensive documentation for regulatory and technical filings, supporting IP protection, preclinical trials, and technology transfer initiatives.

15. Oral Insulin:

- Developed a preclinical formulation for therapeutic evaluation in animal models.
- Designed and optimized the protocol for animal assay, ensuring reproducibility and compliance with ethical and scientific standards.
- Project currently in the developmental stage, with ongoing refinement of dosage forms and in vivo testing strategies to assess safety and efficacy.

16. Dengue Vaccine:

- Prepared the overall strategy and detailed development plan for a multiepitope dengue vaccine, guiding the project from concept to preclinical validation.
- Designed three mammalian expression constructs encoding multiepitope vaccine candidates targeting dengue virus immunodominant regions.
- Developed and optimized expression and purification protocols, leading to efficient production of recombinant vaccine proteins in mammalian systems.
- Successfully completed technology transfer, including protocol for stable cell line development to support scalable and cost-effective production.
- Participated in document preparation for DCGI (Drugs Controller General of India) submissions to support regulatory approvals and compliance.
- Conducted animal studies to evaluate antibody responses, confirming immunogenicity of vaccine constructs.
- Project is currently in the product development phase, progressing toward translational and clinical application.

17. HCG project:

- Designed mammalian expression constructs for the production of recombinant Human Chorionic Gonadotropin (HCG) using CHO (Chinese Hamster Ovary) cells.
- Developed and optimized protocols for high-yield expression and purification of recombinant HCG, ensuring scalability and purity.
- Completed preliminary animal assays to assess bioactivity and safety, with promising initial results supporting further development.

18. Chinese Hamster Ovary based protein purification technology:

- Completed the first set of experiments for recombinant HCG production using CHO cells, validating expression and purification protocols.
- Currently working on alternative strategies to enhance production efficiency and scalability.

- Developing associated technologies to optimize yield, bioactivity, and downstream processing for commercial-scale applications.

19. Therapeutic antibody:

- Developing and optimizing bacterial and mammalian vectors for the expression of monoclonal antibodies**.**
- Designed vector strategies, including the selection of appropriate fragments and primers for efficient cloning and expression.
- Successfully developed two expression vectors tailored to produce high-yield antibodies in both bacterial and mammalian systems.
- Currently focused on the optimization of expression systems and production workflows for scaling up antibody production.

20. Drug Delivery technology:

- Developed multiple drug delivery technologies, including topical delivery systems for localized therapeutic application and AAV-based delivery for gene therapy and targeted treatment.
- Focused on formulation optimization, stability, and bioavailability enhancement for both topical and viral vector-based delivery platforms.
- Aimed at improving efficacy, targeting specificity, and patient compliance through innovative delivery mechanisms.

21. Viral engineering:

- Developing strategies for targeted viral delivery of genetic material, with the aim of enhancing therapeutic efficacy in gene therapy applications.
- Focused on designing viral vectors and targeting mechanisms to ensure precise delivery to specific tissues or cells, improving treatment outcomes.
- Project is in the preparatory phase, with work set to begin soon, aiming to address challenges in specificity, safety, and efficiency of viral gene delivery systems.

22. Retargeting toxins:

- Developing therapeutic biomolecules by retargeting or reengineering toxins to enhance their therapeutic utility for targeted treatments.
- Focused on modifying toxin specificity, potency, and safety to create more effective and precise therapeutic agents for conditions such as cancer, autoimmune diseases, or neurological disorders.
- The project aims to optimize the bioactivity of engineered toxins while minimizing potential side effects, enhancing their applicability in targeted therapy.

23. CAR-T cells-based therapy:

- Developed protocols and strategic plans for the design and implementation of therapeutic biomolecules through toxin retargeting and reengineering.
- Stage I of the project is currently underway, focusing on initial proof-of-concept studies and early validation of engineered constructs.

- Aimed at enhancing target specificity, safety, and therapeutic efficacy of modified toxin-based biomolecules.

24. *Topical Insulin*:
    - Conceptualized and developed the project proposal focused on engineering therapeutic biomolecules by modifying toxin properties for targeted applications.
    - Designed a comprehensive experimental plan outlining key objectives, methodologies, and milestones.
    - Stage I is currently in the planning phase and will commence soon, initiating foundational studies to validate the proposed strategy.

25. Ligand-based CAR-T cells:
    - Developed the overall project framework and designed the experimental strategy for engineering therapeutic biomolecules through toxin modification.
    - Created a detailed plan for experimental execution, including objectives, methodologies, and evaluation criteria.
    - Stage I is scheduled to begin soon, marking the initiation of early-phase research and proof-of-concept validation.

E. Journal Reviewer

1. Peptides
2. Biochemistry and Biophysics Reports
3. Journal of Biochemical and Molecular Toxicology
4. Annals of Neurology
5. Chemical Methodologies
6. Computational and Structural Biotechnology
7. Environmental Toxicology and Pharmacology
8. Marine Drugs
9. Toxins
10. Antibiotics
11. Bulletin of Environmental Contamination and Toxicology
12. Molecules.
13. Biology
14. Infection
15. International Journal of Molecular Sciences
16. Proteomes
17. Bioengineering
18. Frontiers in Neuroimaging
19. Biomedicines

F. Invited Seminar/Symposium Speaker:

1. Advinus Therapeutics, Pune, India, 7th March 2007.
   Topic: CETP (Cholesterol Ester Transferase Protein) as potential target for lowering LDL level.

2. WAVES conference, University of Massachusetts, Dartmouth, 13-15th July 2012.
   Topic: Neurological Link between Diet and Mind.

3. Botulinum Research Symposium, University of Massachusetts, Dartmouth, 16-17th August 2012.
   Topic: Comparative functional folding of BoNT endopeptidase.

4. Youth Camp, University of Massachusetts, Dartmouth, 31st July 2013.
   Topic: Chemistry: Our Life Our Future.

5. Botulinum Research Symposium, UMASS Dartmouth, 14-16th August 2013.
   Topic: Differential Role of Molten Globule and Protein Folding in Distinguishing Unique Features of Botulinum Neurotoxin Endopeptidase.

6. One of the panelists in Panel Discussion 4, Vedanta Conference, 14th July 2013.
   Topic: Vedanta in Academia, Business, Health, and Society.

7. Department of Chemistry and Biochemistry, UMASS Lowell, 7th November 2013.
   Topic: Uniqueness of Botulinum Toxin.

8. Amity University, Gurgaon, 2nd May 2016.
   Topic: Unique Structural and Functional Features of Botulinum Toxin.

9. Botulinum Research Symposium, Institute of Advanced Sciences, 17-19th August 2016.
   Topic: Solution structure of BoNT/A light chain A.

10. Inter Botulinum Research Coordination Committee Conference, 23-26th October 2016.
    Topic: Solution structure of BoNT/A light chain A and its implication in inhibitor design.

11. Mini-Symposium: Modern Relevance of Ancient Indian Education Pedagogy, 29th April, 2017.
    Topic: Characteristics and Relevance of Ancient Educational System.

12. Botulinum Research Symposium, Institute of Advanced Sciences, 16-18th August 2017.
    Topic: Paracellular vs. Transcellular absorption of botulinum neurotoxins.

2. Vedanta Conference, 2017. 13th August 2017.
   Topic: Vedic Perspectives of Origin of the Universe and Life.

14. Inter Botulinum Research Coordination Committee Conference, 22-25th October 2017.
    Topic: Intenstinal absorption of Botulinum Neurotoxin: Paracellular or Transcellular, or Both?

15. Educational Symposium 2018: Creating Standards for Ancient Education Pedagogy, 12th

May 2018.

Topic: Role of Ancient Indian Education Systems in Creating Standards.

16. Anubhav 2018: 16th June 2018.
    Topic: Paradigm Shift in the treatment of disease.

17. Anubhav 2018: 16th June 2018.
    Topic: Evolutionary Theory of Veda.

18. 3rd Integrative Medicine Conference: 23rd June 2018, Harvard Medical School.
    Topic: Ocimum Sanctum: A Source of Holistic Treatment for Neurofibromas.

19. Botulinum Research Symposium, Institute of Advanced Sciences, 15-17th August 2018.
    Topic: Crystal vs Solution Structure: Are we dealing with the right structure of BoNT/A LC?

20. Inter Botulinum Research Coordination Committee Conference, 21-24th October 2018.
    Topic: Why is crystally clear not right in solution for botulinum neurotoxin endopeptidase structure?

21. Department of Chemistry and Biochemistry, UMASS Lowell, 30th November 2018.
    Topic: Botulinum Toxin: A molecule to redefine biochemistry.

22. Botulinum Research Symposium, Institute of Advanced Sciences, 14-16th August 2018.
    Topic: Preliminary investigation on botulinum neurotoxin-based delivery vehicle for axonal regeneration.

23. Inter Botulinum Research Coordination Committee Conference, 21 – 24th October 2019.
    Topic: A novel method for axonal regeneration using botulinum neurotoxin.

24. Botulinum Research Symposium, Institute of Advanced Sciences, 19th August 2020.
    Topic: Botulinum neurotoxin-based delivery vehicle for axonal regeneration.

25. International e-seminar on Global Pandemic and Mental Health. Host: Government Hamidia Arts and Commerce College, Bhopal, Madhya Pradesh, India. 13th September 2020.
    Topic: COVID-19 and mental health.

26. Botulinum Research Symposium, Institute of Advanced Sciences, 19th August 2021.
    Topic: Conformational dynamics of botulinum toxin and its implication on evolution.

27. Vedanta Conference, 30th October 2021.
    Topic: Vedic Theories of Creation.

28. Botulinum Research Symposium, Institute of Advanced Sciences, 17 - 18th August 2022.

Topic: Evolution of Botulinum Neurotoxins and Their Commercial Uses.

29. Inter Botulinum Research Coordination Committee Conference, 17 – 18th October 2022.
Topic: Redefining Evolution using Bacterial Toxins.

30. Mutual Sensibilities of Dharma, Mazahab and Religion, 3rd January 2023.
Topic: Scientific perspectives of spirituality.

31. Mutual Sensibilities of Dharma, Mazahab and Religion, 24th January 2023.
Panel discussion: Scientific and Spiritual Perspectives.

32. Botulinum Research Symposium, Institute of Advanced Sciences, 19th – 21st July 2023.
Topic: Novel and effective nano emulsion for topical administration of Botulinum Neurotoxin A.

33. Inter Botulinum Research Coordination Committee Conference, 23 – 25th October 2023.
Topic: Novel and effective nano-emulsion for topical administration of botulinum toxin A.

34. International symposium on Philosophy and Science as a new educational paradigm, 2nd – 4th February 2024.
Topic: A unique approach for the treatment of cancer using a traditional medicinal plant (Ocimum Sanctum).

35. Drug Controller General of India Board Members, April 2024.
Topic: World's First Oral COVID Vaccine.

G. Teaching Experience:

1. Teaching Assistant at Chemistry and Biochemistry Department, University of Massachusetts, Dartmouth from January 2010 to May 2010 (Freshman chemistry lab).

2. Teaching Assistant at Chemistry and Biochemistry Department, University of Massachusetts, Dartmouth from January 2011 to May 2011 (Biochemistry lab).

3. Teaching Fellow at Chemistry and Biochemistry Department, University of Massachusetts, Dartmouth from September 2011 to December. 2011 (Freshman chemistry instructor for chemistry majors/non-majors).

4. Part-time Lecturer at Chemistry and Biochemistry Department, UMASS, Dartmouth from January 2012 – December 2013 (Freshman chemistry lecture/labs for chemistry majors/non-majors, supervised chemistry lab for seniors).

5. Taught chemistry theory/lab to the students of American Vivekanand Academy, New Hampshire, Fall 2012.

6. Taught a few classes as a visiting lecture. Introduction to Neuroscience, Science of Kriyayoga. University of Massachusetts, Dartmouth. Spring 2014.

H. Undergraduate Teaching:

CHM 151, General Chemistry I (3 semesters)
CHM 152, General Chemistry II (3 semesters)
CHM 161, General Chemistry Laboratory I (3 semesters)
CHM 101, General Chemistry (1 semester)
CHM 162, Chemistry Laboratory II (1 semester)
CHM 163, Chemistry Laboratory I (For Chemistry Major, 1 semester)
CHM 414, Biochemistry Laboratory (1 semester as Teaching Assistant)
IST 111, Science of Kriya Yoga (As a visiting faculty)

Graduate Teaching:

CHM 529, Physical Biochemistry (one three-hour class about Protein Folding)

Student Advisement:

Post-Doc: 1) Soniya Balli
2) Pratyusha Macha Krishna
3) Abhinandan Mani Tripathi
4) Pankaj Soni

Graduate Students: 1) Tom Feltrup (UMASS Dartmouth, USA)
2) Harkiran Preet Kaur Dhaliwal (UMASS Dartmouth, USA)
3) Gowri Chellapan (UMASS Dartmouth, USA)
4) Pavithra Janardhanan (UMASS Dartmouth, USA)
5) Niraj Ramsamooj (UMASS Dartmouth, USA)
6) Avinash Tiwari (Lucknow University, India)

Undergraduate Students: 1) Sara Sabet (Cedars-Sinai, LA, USA)
2) Aisha Furey (Binghamton University, NY, USA)

High School Students: 1) Brooke Spencer (Dartmouth High School, MA)
2) Lindsey Foster (Dartmouth High School, MA)
3) Fardeen Rashid (Dartmouth High School, MA)
4) Zachary Young (Bishop Connelly High School, MA)
5) Pedro de Souza (BMC Durfee High School, MA)
6) Leilani Rockwell (Rock Canyon High School, CO)
7) Alice Wong (Taunton High School)
8) Andrew Zhu (Dartmouth High School)
9) Sofia Levitt (Dartmouth High School)
10) Camron Vaillancourt (Dartmouth High School

11) Suyesha Athuluri (Dartmouth High School)

I. Research Interest:

Bio-Molecular spectroscopy, Protein folding and dynamics, Cellular biology including genetic modifications, Molecular Dynamics Simulation, Protein NMR and Neurobiochemistry, Drug delivery, Viral engineering, Toxin reengineering, Therapeutic biomolecules, and Genetic medicines.

J. Organized Symposiums and Seminars

1) Education Symposium 2016, Attelboro, MA
2) Education Symposium 2017, Fall River, MA
3) BRC Symposium 2014 – 2023, New Bedford, MA
4) Mini-Symposium 2021, Virtual symposium
5) KSAS inauguration event 2022, Lucknow, India
6) International symposium on Philosophy and Science as a new educational paradigm, 2024, Lucknow, India.
7) International conference on Consciousness through Science and Philosophy, 2025, Lucknow India.

K. Publications:

1. **Kumar, R.,** Zhou, Y., Ghosal, K., Cai, S., and Singh, B. R. (2012) Anti-apoptotic activity of hemagglutinin-33 and botulinum neurotoxin and its implication to therapeutic and countermeasure issues. Biochemical and Biophysical Research Communication, 417, 726-731.

2. Singh, B. R., and **Kumar, R.** (2012) Modern scientific view of Ayurveda. Light on Ayurveda Journal, XI, 16-22.

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L. Manuscripts (in preparation):

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2. Dhaliwal, H. P. K., **Kumar, R.**, Cai, S., Singh, B. R., and Thirunauvukkarasu, N. Identification of channel-forming motifs in botulinum neurotoxins and characterization of ion-channel deficient mutation in type A toxin (*in preparation: to be submitted soon*).

3. Dhaliwal, H. P. K., Thirunauvukkarasu, N., **Kumar, R.**, Ghoshal, K., Cai, S., and Singh, B. R. Botulinum Neurotoxin Type A Light Chain Host-Cell Mediated Phosphorylation Mechanisms in M17 Neuroblastoma Cells (*in preparation: to be submitted soon*).

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M. Published Book

1. **Protein Toxins in Modeling Biochemistry (Authors: Raj Kumar and Bal Ram Singh)** Published in Springer Brief, ISBN 978-3-319-43538-1, 978-3-319-43540-4 (ebook).

2. **Principles Techniques in Molecular Biotechnology (Authors: Raj Kumar and Bal Ram Singh)** Cambridge University Press, ISBN 978-1-108-48640-8.

N. Book and Book Chapters in process of submission:

1. Bal Ram Singh, **Raj Kumar.** Redefining evolution (*in preparation*).
2. Advanced Biotechnology (**Authors: Raj Kumar and Bal Ram Singh**). CRC press (in preparation).
3. Education Symposium (Editors: Raj Kumar and Bal Ram Singh). INADS Press, MA, USA. (in preparation).

O. Peer-reviewed Blogs:

1. Scientific Significance of OM (published on Feb 3, 2016 in a peer reviewed blog).
2. Characteristics of ancient Indian educational system (published on Sep 24, 2016 in a peer reviewed blog).
3. How to integrate the ancient educational system with the modern educational system (published on Oct 1, 2016 in a peer reviewed blog).
4. Vibration: The cause of our existence and its connection with Vedic philosophy (Part-I) (published on Oct 11, 2017 in a peer reviewed blog).
5. Vibration: The cause of our existence and its connection with Vedic philosophy (Part-II) (published on Oct 13, 2017 in a peer reviewed blog).
6. India: A concept of nationhood (Part-I) published on Jan 26, 2018 in a peer reviewed

blog).

7. India: A concept of nationhood (Part-II) published on Jan 27, 2018 in a peer reviewed blog).

P. Patents:

1) Treatment of malignant neurofibroma with *Ocimum Sanctum* hydrophilic fraction-1 (OSHP-1) (Application no: USPTO62/690369). C.S.K. Mayanil, **Raj Kumar**, Bal Ram Singh, Tadanori Tomita (**awarded in 2022).**

2) A complex of botulinum neurotoxin E and its binding protein as a formulation with enhanced potency. **Raj Kumar**, Bal Ram Singh (Application no: USPTO17200822) **(awarded in 2024).**

3) A complex of botulinum neurotoxin E and its binding protein as a formulation with enhanced potency. **Raj Kumar**, Bal Ram Singh (Application no: USPTO18601211) **(Continuation in part awarded in 2025).**

4) A protein-based vaccine and production method thereof for SARS COV-2. **Raj Kumar**, Bal Ram Singh (PCT application to several countries) (**Granted in USA: 18/060401; Granted by South African Patent Office in 2024; PCT application also approved by USPTO**).

5) Topical formulation of botulinum neurotoxin. **Raj Kumar,** Bal Ram Singh (submitted to USPTO and foreign filing license granted, filed in India and in process of submission to PCT).

6) A Pharmaceutical composition comprising P80 protein. Bal Ram Singh, Sirisha Mukkawali, **Raj Kumar**, Paul Lindo (Application no: USPTO62570742) (under review).

7) Multiepitope vaccine platform for Dengue. **Raj Kumar**, Bal Ram Singh. (submitted to USPTO; under review; Filing in INDIA and PCT are in process).

8) Novel Expression Vector. **Raj Kumar**, Bal Ram Singh, Abhinandan Mani Tripathi (Submitted to Indian Patent Office).

9) Novel Universal Substrate for the Detection of Botulinum Toxins. **Raj Kumar,** Bal Ram Singh. (Application no: USPTO 17339263, under review).

10) A pharmaceutical preparation for increasing stability and bioavailability of botulinum Toxin A and its complex. **Raj Kumar**, and Bal Ram Singh (Application no: USPTO 62/623,711) (abandoned).

Q. Awarded Patent:

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2) A complex of botulinum neurotoxin E and its binding protein as a formulation with enhanced potency. **Raj Kumar**, Bal Ram Singh (Application no: USPTO17200822) **(Granted).**

3) Tetanus vaccine platform for embedding Covid-19 vaccine. Bal Ram Singh, Kruti Patel and **Raj Kumar**. **(Granted by South African Patent Office; USPTO granted)**.

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R. Poster Presentations

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2. **Raj Kumar**, Yu Zhou, Koyel Ghosal, Shuowei Cai, Bal Ram Singh (2008) Anti-apoptotic property of Hn-33. Second Annual Botulinum Research Symposium, UMASS Dartmouth, August 20-21, 2008.

3. **Raj Kumar**, Li Li, Roshan Kukreja, Shuowei Cai, Bal Ram Singh (2009) A biologically active intermediate of urea denaturation in botulinum neurotoxin endopeptidase. Inter Botulinum Research Coordination Committee Conference (2009) in Alexandria, VA; 15th Annual Sigma Xi Research Exhibit, University of Massachusetts Dartmouth, North Dartmouth, MA, April 28-29, 2009, and Third Annual Botulinum Research Symposium, UMASS Dartmouth, August 20-21, 2009.

4. **Raj Kumar**, Silvi Agarwal, Artem Zhumarov, Valerie Bargesov, Bal Ram Singh (2010). MD simulation of BoNT/A LC. 16th Annual Sigma Xi Research Exhibit, University of Massachusetts Dartmouth, North Dartmouth, MA, April 28-29, 2010, and in Fourth Annual Botulinum Research Symposium, August 19-20, 2010.

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23. Raj Kumar, Pedro De Sousa, Thomas M. Feltrup, and Bal Ram Singh. A Novel and innovative approach for axonal regeneration after spinal cord injury (SCI). Botulinum Research Symposium, 16-18th August 2017; Inter Botulinum Research Coordination Committee Conference in Philadelphia, October 25-28, 2015.

24. Ghuncha Ambrin, **Raj Kumar,** and Bal Ram Singh. Distinctive endopeptidase activity of different forms of type A botulinum neurotoxin. Botulinum Research Symposium, 16- 18th August 2017.

25. Soniya Balli, **Raj Kumar**, and Bal Ram Singh. Functional characterization of p80 and Hn33 in Caco2 and HT29 cell lines. Botulinum Research Symposium, 16 - 18th August 2017.

26. Niraj Ram Samooj, Bal Ram Singh, and **Raj Kumar**. Cloning, expression, and purification of recombinant C3 exoenzyme. Botulinum Research Symposium, 15 - 17th August 2018.

27. Niraj Ramsamooj, Shuowei Cai, and **Raj Kumar**. A novel oral delivery platform for therapeutic proteins. Botulinum Research Symposium, 15 - 17th August 2018.

28. Thomas Feltrup, Kruti Patel, **Raj Kumar**, Shuowei Cai, and Bal Ram Singh. A novel role of C-terminus in introducing a functionally flexible structure critical for the biological activity of botulinum neurotoxin. Botulinum Research Symposium, 15 - 17th August 2018.

29. Kruti Patel, Thomas Feltrup, **Raj Kumar**, and Bal Ram Singh. Detoxified Recombinant Botulinum Neurotoxin Light chain B. Botulinum Research Symposium, 15 - 17th August 2018.

30. Andrew Zhu, Niraj Ramsamooj, Sirisha Mukkavalli, **Raj Kumar**, Bal Ram Singh. Investigation into experimental green synthesis of phytonanoparticles for vaccine delivery. Botulinum Research Symposium, 15 - 17th August 2018.

31. Niraj Ramsamooj, Alice Wong, **Raj Kumar**, Bal Ram Singh. Binding and internalization of detoxified recombinant botulinum neurotoxin to M17 neuronal cells. Botulinum Research Symposium, 15 - 17th August 2018.

32. **Raj Kumar** and Bal Ram Singh. Mechanism of Evolution: An Alternative View. Botulinum Research Symposium, 14 - 16th August 2019.

33. Niraj Ramsamooj, Bal Ram Singh and **Raj Kumar**. Purification of engineered botulinum toxin for axonal regeneration. Botulinum Research Symposium, 14 - 16th August 2019.

34. Weiping Yang, Kruti Patel, Paul Lindo, **Raj Kumar**, Bal Ram Singh. Botulinum toxin associated proteins as carriers for the oral delivery of tetanus vaccine. Botulinum Research Symposium, 14 - 16th August 2019.

S. Memberships:

1. American Academy of Advancement of Science Member (2009 - 2017).
2. American Chemical Society Member (2010-2012)
3. American Federation of Teachers (2012 - 2014)
4. Society for Science and Public (2014 - present)
5. American Society for Pharmacology and Experimental Therapeutics (ASPET) (2015 - 2019).

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