

Raj Kumar, PhD  
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## **1.0 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.

## **2.0 Position Held:**

- 1. Institute of Advanced Sciences, Dartmouth (March 2014 – present):** Assistant Professor.  
Responsibilities include Research and development in the area of protein chemistry, diagnostics, drug screening, drug delivery, cell culture, nanoparticles and biotechnology through conducting a variety of specialized laboratory procedures and researches. Specifically, isolation and purification of native and recombinant proteins, biochemical and biophysical characterization, structural analysis using UV/VIS spectrophotometry, fluorescence spectroscopy, circular dichroism, fluorescence microscopy, etc., development of antidotes against botulinum neurotoxins, extraction of bioactive compounds from plants, screening of synthetic and natural compounds against enzymatic activity of Botulinum neurotoxins, culture and testing of neuroblastoma cells and enteric neurons for testing neuroactive compounds, development of enzyme linked immunosorbent assay (ELISA) against pathogenic compounds, characterization and testing of vaccine candidates against tetanus and botulinum toxins; coordinate research with collaborators at federal and corporation labs; organize and maintain research data and perform data analysis using lab information management system; writing grant proposals and submit to various agencies, including NIH and DOD; report to Director of Research and Development, and CEO on issues related to project progresses and potential problems or difficulties in the projects. Member of IACUC (Institutional Animal

Care and Use committee) and IBC (Institutional Biosafety Committee). Promoted to Director of Academic Advisement and Research Program at INADS in Sep. 2018.

2. **Chemistry and Biochemistry Department, UMASS Dartmouth (January 2012 - December 2014):** As a part-time lecturer.
3. **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.
4. **Botulinum Research Center (January 2012 - August 2013):** Research Associate, responsible for writing grant proposals, experimentation, presentation, and assisting graduate and undergraduate students.
5. **Botulinum Research Center, UMASS DARTMOUTH (September 2007 - December 2011):** As a graduate student pursued my PhD work.
6. **Advinus Therapeutics, Pune, INDIA (A member of TATA group) (February 2006 - July 2007):** Worked as an analytical scientist in drug discovery department. Responsible for the purification of organic compound using mass-based purification technique, qualitative/quantitative analysis and characterization of compounds.
7. **Regent Drugs Limited, INDIA (A member of TEVA group) (January 2004 - February 2006):** In charge of three different projects. Responsible for the whole project; from literature search till validation of analytical methods and stability of final products. Also responsible for daily planning of team members. Presentation and communication of the group work in various internal and external meetings.
8. **LUPIN Research Park, Pune, INDIA (June 2001 - January 2004):** Started as trainee in analytical research and development department. Responsible for routine analysis. After first year promoted as Assistant research Scientist (E-I), responsible for routine analysis, analytical method development, qualitative and quantitative analysis. Next year promoted as research scientist (E-II), responsible for routine analysis, analytical method development, validation and stability. Responsible for planning of my team and project report preparation and communication to the other concerned department. Also responsible for transferring the analytical methods to QC and successfully performed various pilot projects.

### **3.0 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.

### **4.0 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

## 5.0 Invited Seminar/Symposium Speaker:

1. Advinus Therapeutics, Pune, India, 7<sup>th</sup> March 2007.  
**Topic:** CETP (Cholesterol Ester Transferase Protein) as potential target for lowering LDL level.
2. WAVES conference, University of Massachusetts, Dartmouth, 13-15<sup>th</sup> July 2012.  
**Topic:** Neurological Link between Diet and Mind.
3. Botulinum Research Symposium, University of Massachusetts, Dartmouth, 16-17<sup>th</sup> August 2012.  
**Topic:** Comparative functional folding of BoNT endopeptidase.
4. Youth Camp, University of Massachusetts, Dartmouth, 31<sup>st</sup> July 2013.  
**Topic:** Chemistry: Our Life Our Future.
5. Botulinum Research Symposium, UMASS Dartmouth, 14-16<sup>th</sup> 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, 14<sup>th</sup> July 2013.  
**Topic:** Vedanta in Academia, Business, Health, and Society.
7. Department of Chemistry and Biochemistry, UMASS Lowell, 7<sup>th</sup> November 2013.  
**Topic:** Uniqueness of Botulinum Toxin.
8. Amity University, Gurgaon, 2<sup>nd</sup> May 2016.  
**Topic:** Unique Structural and Functional Features of Botulinum Toxin.
9. Botulinum Research Symposium, Institute of Advanced Sciences, 17-19<sup>th</sup> August 2016.  
**Topic:** Solution structure of BoNT/A light chain A.
10. Inter Botulinum Research Coordination Committee Conference, 23-26<sup>th</sup> 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, 29<sup>th</sup> April, 2017.  
**Topic:** Characteristics and Relevance of Ancient Educational System.
12. Botulinum Research Symposium, Institute of Advanced Sciences, 16-18<sup>th</sup> August 2017.  
**Topic:** Paracellular vs. Transcellular absorption of botulinum neurotoxins.
13. Inter Botulinum Research Coordination Committee Conference, 22-25<sup>th</sup> October 2017.

**Topic:** Intestinal absorption of Botulinum Neurotoxin: Paracellular or Transcellular, or Both?

14. Educational Symposium 2018: Creating Standards for Ancient Education Pedagogy, 12<sup>th</sup> May 2018.

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

15. Anubhav 2018: 16<sup>th</sup> June 2018.

**Topic:** Paradigm Shift in the treatment of disease.

16. Anubhav 2018: 16<sup>th</sup> June 2018.

**Topic:** Evolutionary Theory of Veda.

17. 3<sup>rd</sup> Integrative Medicine Conference: 23<sup>rd</sup> June 2018, Harvard Medical School.

**Topic:** *Ocimum Sanctum*: A Source of Holistic Treatment for Neurofibromas.

18. Botulinum Research Symposium, Institute of Advanced Sciences, 15-17<sup>th</sup> August 2018.

**Topic:** Crystal vs Solution Structure: Are we dealing with the right structure of BoNT/A LC?

19. Inter Botulinum Research Coordination Committee Conference, 21-24<sup>th</sup> October 2018.

**Topic:** Why is crystalline not right in solution for botulinum neurotoxin endopeptidase structure?

20. Department of Chemistry and Biochemistry, UMASS Lowell, 30<sup>th</sup> November 2018.

**Topic:** Botulinum Toxin: A molecule to redefine biochemistry.

21. Botulinum Research Symposium, Institute of Advanced Sciences, 14-16<sup>th</sup> August 2019.

**Topic:** Preliminary investigation on botulinum neurotoxin-based delivery vehicle for axonal regeneration.

22. Inter Botulinum Research Coordination Committee Conference, 21-24<sup>th</sup> October 2020.

**Topic:** A novel method for axonal regeneration using botulinum neurotoxin.

23. International e-seminar on Global Pandemic and Mental Health. Host: Government Hamidia Arts and Commerce College, Bhopal, Madhya Pradesh, India. 13<sup>th</sup> September 2020.

**Topic:** COVID-19 and mental health.

## 6.0 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 chemistry lab at University of Massachusetts, Lowell, Fall 2018

### **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 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)

## **7.0 Student Advisement:**

**Post Docs:** 1) Soniya Balli  
2) Pratyusha Krishna Macha

**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)

**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 Connely 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 Vailliancourt (Dartmouth High School)

## 8.0 Research Interest:

Bio-Molecular spectroscopy, Protein folding and dynamics, Cellular biology, Molecular Dynamics Simulation, Protein NMR and Neurobiochemistry.

## 9.0 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.
3. Singh, B. R., **Kumar, R.**, and Cai, S. (2013) Molecular mechanism and effects of Clostridial neurotoxins. In *Handbook of Neurotoxicity* (Editor: Kostrzewa, Richard M, Springer), Springer Publication, New York, 513 - 551.
4. **Kumar, R.**, Kukreja, R. V., Li, L., Zhmurov, A., Kononova, O., Cai, S., Ahmed, S. A., Barsegov, V., and Singh, B. R. (2014) Botulinum neurotoxin: unique folding of enzyme domain of the most-poisonous poison. *Journal of Biomolecular Structure and Dynamics*, 32, 804-815.
5. **Kumar, R.**, Chang, T. W., and Singh, B. R. (2013) Evolutionary traits of toxins. *Handbook of Toxinology* (Editor: P. Gopalakrishnakone, Springer): *Biological Toxins and Bioterrorism*, Springer Dordrecht Heidelberg New York London, Vol 1, chapter 23, 527 - 557.

6. **Kumar, R.**, Kukreja, R., Cai, S. and Singh, B. R. (2014) Differential Role of Molten Globule and Protein Folding in Distinguishing Unique Features of Botulinum Neurotoxin. *Biochimica et Biophysica Acta – Proteins and Proteomics*, 1844, 1145-1152.
7. Chellappan, G., **Kumar, R.**, Cai, S., and Singh, B. R. (2014) Role of neurotoxin associated proteins in the Low pH induced structural changes in the botulinum neurotoxin complex. *The Protein Journal*, 33, 557 - 564.
8. **Kumar, R.**, Cai, S., and Singh, B. R. (2015) Resolution of sub-nano second motion in BoNT/A LC: An evidence of internal flexibility. *Biochimica et Biophysica Acta – Proteins and Proteomics*, 1854, 321- 326.
9. Chellapan, G., **Kumar, R.**, Goyal, D., Cai S., and Singh, B. R. (2015) Structural and functional analysis of botulinum neurotoxin subunits for pH-dependent membrane channel formation and translocation. *Biochemical et Biophysica Acta — Proteins and Proteomics*, 1854, 1510 – 1516.
10. **Kumar, R.**, Dhaliwal, H. P. K., Kukreja, R. V., and Singh, B. R. (2016). Botulinum toxins: Molecular structure and mechanisms of action in motor and sensory systems. *Seminars of Neurology*. 36, 10 -19.
11. Feltrup, T., Patel, K., **Kumar, R.**, Cai, S., and Singh, B. R. (2018) Differential structural and functional features of full length and truncated Light chain of Botulinum Toxin A. *Scientific Reports*.
12. **Kumar R.** (2018) A Review on Therapeutic use of Botulinum Toxin in Pain Treatment. *Neuronal Signalling*, NS20180058; **DOI:** 10.1042/NS20180058.
13. Dhaliwal, H. P. K., Thiruvanakarassu, N., **Kumar, R.**, Patel, K., Ambrin, G., Cai, S., and Singh, B. R. (2018). High Yield Preparation of Functionally Active Catalytic-Translocation Domain Module of Botulinum Neurotoxin Type A That Exhibits Uniquely Different Enzyme Kinetics. *The Protein Journal*, 36, 486 – 491.
14. Ambrin, G., **Kumar, R.**, and Singh, B. R. (2018). Differential endopeptidase activity of different forms of type A botulinum neurotoxin: A unique relationship between the size of the substrate and activity of the enzyme. *Toxicon*, 144, 34 – 41.
15. **Kumar, R.**, Feltrup, T. M., Kukreja, R. V., Patel, K. B., Cai, S., and Singh, B. R. (2019). Evolutionary features in the structure and function of bacterial toxins. *Toxins*, 11, 1 - 23.



16. Monik, S., Mohanty, V., Khan, M., Yerneni, G., **Kumar, R.**, Cantu, J., Ichi, S., Xi, G., Singh, B. R., Tomita, T., and Mayanil, C. S. (2019). A phenotypic switch of differentiated glial cells to dedifferentiated cells is regulated by folate receptor a. *Stem Cells*, <http://dx.doi.org/10.1002/stem.3067>.
17. **Kumar, R.**, Maksudov, F., Kononova, O., Marx, K. A., Barsegov, V., Singh, B. R. (2020). Botulinum Endopeptidase: SAXS experiments and MD simulation reveal extended solution structures that accounts for its biochemical properties. *Journal of Physical Chemistry B*, <https://doi.org/10.1021/acs.jpccb.0c02817>
18. Patel, K. B., Kononova, O., Cai, S., Barsegov, V., Parmar, V., **Kumar, R.**, and Singh, B. R. Botulinum neurotoxin inhibitor binding dynamics and kinetics relevant for drug design (*submitted to Biochemistry*).

## 10. Manuscripts in preparation:

1. Dhaliwal, H. P. K., **Kumar, R.**, Cai, S., Singh, B. R., and Thirunavukkarasu, 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*).
2. Dhaliwal, H. P. K., Thirunavukkarasu, 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*).
3. Mayanil, C. S. K., **Kumar, R.**, Singh, B. R. and others. (*in preparation*).

## 11.0 Published Book

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

## 12.0 Book and Book Chapters in process of submission:

1. Bal Ram Singh, **Raj Kumar**. Principles and Applications of Biomedical Engineering, Cambridge University Press, contract signed and currently working on the book (*to be submitted soon*).

2. **Raj Kumar** and Bal Ram Singh. Molten Globule in Structure, Function, and Evolution of Proteins. Contract signed and currently working on the book.
3. A chapter in 2<sup>nd</sup> edition of the *Handbook of Neurotoxicity*. Title yet to be decided (deadline November 2020).
4. Lei Wang, Ghuncha Ambrin, **Raj Kumar**, Bal Ram Singh. Neuronal Regeneration and Degeneration. (to be submit in November 2020).
5. **Raj Kumar**. Vedic Perspectives on origin of universe and life. Proceedings of Vedanta Conference 2017 (Submitted).

### 13.0 Patents:

1. Composition of Oral or Nasal Delivery of Tetanus, Diphtheria, and Pertussis Vaccine alone or in combination using Neurotoxin Associated Proteins. Weiping Yang, **Raj Kumar**, Paul Lindo, Bal Ram Singh. (Application no.: USPTO 15/064,651).
2. Novel Universal Substrate for the Detection of Botulinum Toxins. Weiping Yang, **Raj Kumar**, Bal Ram Singh. (Application no: USPTO 15/418,810).
3. A Pharmaceutical composition comprising P80 protein. Bal Ram Singh, Sirisha Mukkawali, **Raj Kumar**, Paul Lindo (Application no: USPTO62570742).
4. 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).
5. Treatment of malignant neurofibroma with *Ocimum Sanctum* hydrophilic fraction-1 (OSHP-I) (Application no: USPTO62/690369). C.S.K. Mayanil, **Raj Kumar**, Bal Ram Singh, Tadanori Tomita.
6. A novel active form of Botulinum Toxin E. (To be submitted: **Raj Kumar** and Bal Ram Singh).

### 14.0 Poster Presentations:

1. **Raj Kumar**, Shuowei Cai, and Bal Ram Singh (2008) Protein flexibility through hydrogen exchange, 14<sup>th</sup> Annual Sigma Xi Research Exhibit, University of Massachusetts Dartmouth, North Dartmouth, MA, April 29-30, 2008.
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. 16<sup>th</sup> 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.
5. **Raj Kumar**, R. Kukreja, Li Li, Shuowei Cai, Syed A. Ahmed, and Bal Ram Singh (2011) A unique urea denaturation pattern of botulinum neurotoxin A endopeptidase. 17<sup>th</sup> Annual Sigma Xi Research Exhibit, University of Massachusetts Dartmouth, North Dartmouth, MA, April 2011, and in Fifth Annual Botulinum Research Symposium, August 18-19, 2011.
6. **Raj Kumar**, Emmanuel Ojadi, Shuowei Cai and Bal Ram Singh (2011) Resolution of sub-nanosecond motion of BoNT/A endopeptidase: An evidence of internal flexibility. Fifth Annual Botulinum Research Symposium, August 18-19, 2011, and Eight Annual Botulinum Research Symposium, August 13-15, 2014
7. **Raj Kumar**, Mario J. Oliveira, Shuowei Cai, and Bal Ram Singh (2012) Dynamics of BoNT/A endopeptidase during catalysis. 18<sup>th</sup> Annual Sigma Xi Research Exhibit, University of Massachusetts Dartmouth, North Dartmouth, MA, April 30, 2012.
8. **Raj Kumar**, Jordan Burke, Marco Tonelli, Milo Westler, Shuowei Cai, and Bal Ram Singh (2013) SAXS and NMR analyses of active conformational states of BoNT/A endopeptidase. 19<sup>th</sup> Annual Sigma Xi Research Exhibit, University of Massachusetts Dartmouth, North Dartmouth, MA, April 23-24, 2013, Sigma XI, and Sixth Annual Botulinum Research Symposium, August 15-16, 2011.
9. **Raj Kumar**, Shuowei Cai, and Bal Ram Singh (2013) Effect of Digested peptides from dietary proteins on regulation of natural health. 19<sup>th</sup> Annual Sigma Xi Research Exhibit, University of Massachusetts Dartmouth, North Dartmouth, MA, April 23-24, 2013; National Ayurvedic Medical Association, April 14 - 16, 2016, Warwick, Rhode Island, USA.
10. Thomas Feltrup, **Raj Kumar**, Shuowei Cai, and Bal Ram Singh (2013) Differential activity of BoNT/A and BoNT/E with respect to substrate length demonstrates the involvement of exosite binding in endopeptidase activity. 19<sup>th</sup> Annual Sigma Xi Research Exhibit, University of Massachusetts Dartmouth, North Dartmouth, MA, April 23-24, 2013, and in Seventh Annual Botulinum Research Symposium, August 15-16, 2013.

11. Gowri Chellappan, **Raj Kumar**, Shuowei Cai, and Bal Ram Singh (2013) Role of neurotoxin Associated Proteins in the Low pH Induced Structural Changes in the Botulinum Neurotoxin Complex. 19<sup>th</sup> Annual Sigma Xi Research Exhibit, University of Massachusetts Dartmouth, North Dartmouth, MA, April 23-24, 2013; Seventh Annual Botulinum Research Symposium, August 15-16, 2013.
12. Harkiranpreet Dhaliwal, Nagarajan Thirunavukkarasu, **Raj Kumar**, Paul K. Kinker, Easwaran Ravichandran, Alan Fikelstein, Shuowei Cai and Bal Ram Singh (2013) Identification of ion-channel forming structural determinants in botulinum neurotoxins. 19<sup>th</sup> Annual Sigma Xi Research Exhibit, University of Massachusetts Dartmouth, North Dartmouth, MA, April 23-24, 2013; Seventh Annual Botulinum Research Symposium, August 15-16, 2013, and in Inter Botulinum Research Coordination Committee, Maryland, October 21-25, 2013.
13. **Raj Kumar**, Jordon Burke, and Bal Ram Singh (2014) Active Conformational States of Botulinum Endopeptidase as Determined by SAXS. Eight Annual Botulinum Research Symposium, August 13-15, 2014.
14. Brook Spencer, Lindsey Foster, Sara Sabet, **Raj Kumar**, Kodumudi Venkat Venkateshwaran, Shuowei Cai, and Bal Ram Singh (2014) A Combination of Isoelectric and Ammonium Sulfate Precipitation Enhances Detection of BoNT/A in a Monoclonal Antibody based Sandwich ELISA. Eight Annual Botulinum Research Symposium, August 13-15, 2014. Ninth Annual Botulinum Research Symposium, August 12-14, 2015.
15. **Raj Kumar**, Olga Kononova, Shuowei Cai, Valeri Barsegov, and Bal Ram Singh (2014) Dynamic Solution Structure of BoNT/A Light Chain Critical for Binding to Potential Inhibitors. Inter Botulinum Research Coordination Committee Conference in Philadelphia, October 26-29, 2014.
16. **Raj Kumar**, and Bal Ram Singh (2015). Virtual Screening of small molecule inhibitor against BoNT/A LC. Ninth Annual Botulinum Research Symposium, August 12-14, 2014.
17. **Raj Kumar**, Kruti Patel, Shuowei Cai and Bal Ram Singh (2015 and 2016). Virtual Screening and ADMET analysis of endopeptidase inhibitors. Inter Botulinum Research Coordination Committee Conference in Philadelphia, October 25-28, 2015. and Bio-Science Meeting, Baltimore, June 7, 2016.
18. **Raj Kumar**, Wei Ping Yang, Thomas Feltrup, Guncha Ambrin, Tzuu Wang Chang, Paul Lindo, Shuowei Cai, and Bal Ram Singh (2015). Size and structures of SNAP-25 substrates and botulinum neurotoxin endopeptidase influence enzyme assays. Inter Botulinum Research Coordination Committee Conference in Philadelphia, October 25-28, 2015; Botulinum Research Symposium, August 17 - 19, Institute of Advanced Sciences, New Bedford, 2016.
19. Bal Ram Singh, Sirisha Mukkavalli, and **Raj Kumar** (2015). Vedantic Foundations of

Ayurvedic Science and Technology. Vedanta Conference at Jawaharlal Nehru University, India, December 27 - 30, 2015.

20. Easwaran Ravichandran, Jenny Davis, Lei Wang, Kruti Patel, **Raj Kumar** and Bal Ram Singh (2016) Development of recombinant protein-based vaccine for BoNT. Bioscience meeting, Baltimore, June 7, 2016.
21. Aisha Furey, **Raj Kumar**, Bal Ram Singh (2016). Investigation of cellular binding and effect of P-80 on Caco-2 cells. Botulinum Research Symposium, 17 - 19th August 2016.
22. Thomas Feltrup, Kruti Patel, **Raj Kumar**, Shuowei Cai, and Bal Ram Singh (2016). The implications of the BoNT/A endopeptidase C-terminus on substrate binding, enzyme activity, and maintaining a functionally disordered structure in solution. Botulinum Research Symposium, 17 - 19th August 2016.
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, 16-18<sup>th</sup> 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 - 18<sup>th</sup> 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 - 18<sup>th</sup> August 2017.
26. Niraj Ram Samooj, Bal Ram Singh, and **Raj Kumar**. Cloning, expression, and purification of recombinant C3 exoenzyme. Botulinum Research Symposium, 15 - 17<sup>th</sup> August 2018.
27. Niraj Ramsamooj, Shuowei Cai, and **Raj Kumar**. A novel oral delivery platform for therapeutic proteins. Botulinum Research Symposium, 15 - 17<sup>th</sup> 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 - 17<sup>th</sup> August 2018.
29. Kruti Patel, Thomas Feltrup, **Raj Kumar**, and Bal Ram Singh. Detoxified Recombinant Botulinum Neurotoxin Light chain B. Botulinum Research Symposium, 15 - 17<sup>th</sup> 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 - 17<sup>th</sup> 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 - 17<sup>th</sup> August 2018.

32. **Raj Kumar** and Bal Ram Singh. Mechanism of Evolution: An Alternative View. Botulinum Research Symposium, 14 - 16<sup>th</sup> August 2019.
33. Niraj Ramsamooj, Bal Ram Singh and **Raj Kumar**. Purification of engineered botulinum toxin-based for axonal regeneration. Botulinum Research Symposium, 14 - 16<sup>th</sup> 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 - 16<sup>th</sup> August 2019.
35. **Raj Kumar**, Farkhad Maksudov, Olga Kononova, Kenneth A. Marx, Valeri Barsegov, and Bal Ram Singh. Botulinum Endopeptidase: SAXS experiments and MD simulations reveal extended solution structures that account for its biochemical properties. Botulinum Research Symposium, 21 - 24<sup>th</sup> August 2020.

## 15.0 Awarded Grant

1. A Novel and Innovative Approach for Axonal Regeneration after Spinal Cord Injury (SCI).  
**Agency: NIH RO3 (2018-2021)**

## 16.0 Other Publications

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).

## 17.0 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 - present).

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