



- Fall 2010-Spring 2011 & Spring 2013      **Assistant Professor** (Adj.) Department of Sciences, BMCC, City University of New York, NY, USA
- 2004-2005      **Postdoctoral Fellow**, School of Medicine, Stanford University, Stanford, California, USA.
- 2002-2004      **Postdoctoral Fellow**, Department of Chemistry & Biochemistry, Hunter College, City University of New York, New York, USA.

**Teaching:**

Classroom: Graduate & Undergraduate: Biochemistry, Molecular Biology, Biotechnology, Microbiology, General Biology, Human Anatomy & Physiology, & General Chemistry.

**Mentoring:**

*Completed Several Undergraduate and Graduate Students Research Projects aiming on the Gene Regulation of Protein Synthesis and viral protein synthesis.*

**Awards, Scholarships, Fellowships, and Grants**

- Receive 2015-16 Internal Research Grant (IRG16414), Alfaisal University, Riyadh, Kingdom of Saudi Arabia.
- Receive 2010 American Society for Biochemistry and Molecular Biology travel award for the "Research Associate Scientist" in Experimental Biology meeting, 2010, Anaheim, CA, USA, April 24-28.
- Receive 2009 American Society for Biochemistry and Molecular Biology travel award for the "Postdoctoral Research Scientist" in Experimental Biology meeting (EB-2009), New Orleans, USA.
- Receive 2008 American Society for Biochemistry and Molecular Biology award for the "Postdoctoral Research Scientist" in Experimental Biology meeting (EB-2008), San Diego, CA, USA.
- Receive 2006 American Society for Biochemistry and Molecular Biology award for the "Postdoctoral Research Scientist" in Experimental Biology meeting (EB-2006), San Francisco, CA, USA.
- 2004 Score, NIH postdoctoral travel Award. For the purpose of presenting at the Biophysical Society meeting.
- RCMI, NIH postdoctoral research fellowship (2002-2004). Awarded for pursuit of postdoctoral project at Hunter College CUNY.
- Recipient of Government of India Sponsored Fellowship (DBT) in Master program of Biotechnology (1995-96), Department of Biotechnology, AM University, India.
- Recipient of 1989 undergraduate award for excellence in Science poster presentation on National Science day, City School of AM University, Aligarh, U.P. India.

**Professional Activities and Services**

Member, American Society of Biochemistry & Molecular Biology  
Member, American Biophysical Society  
Member, New York Academy of Science  
Member, FASEB  
Member, American Chemical Society  
Member, European Federation of Biotechnology

Member, National Education Association of Teachers for Higher Educations, USA.  
Member of Judge Committee of the New York City Science and Engineering fair (**NYCSEF**)  
New York City, 2011-2012

### **Scientific Recognition**

#### **Newsletter Brief Summer 2011:**

Selected for summer 2011 News Letter Brief by Gene Centre, Sponsored by National Institute of Health, for the achievements of the “Best Research” by young Scientist at City University of New York. <http://genecenter.hunter.cuny.edu>

#### **Newsletter Issue 2010:**

Selected for 2010 News Letter Brief by Gene Centre, Sponsored by National Institute of Health, for the achievements of the “Best Research” by young Scientist at City University of New York. <http://genecenter.hunter.cuny.edu>

#### **Recognition by Scientific Society:**

New finding of my research work on VPg has been recognized by the *Faculty of 1000 Biology Scientist*. Their comments are published in Faculty of 1000 website (<http://www.f1000biology.com>).

### **Major Research Areas**

- Gene Regulation of Iron Metabolism
- Protein-Protein and Protein-Nucleic Acid Interactions
- Viral Protein Biosynthesis

### **Publications**

#### **Text Book**

Mateen Khan (2011) “Tetracyclines and Macromolecule” LAP LAMBERT Academic Publishing GmbH & Co. KG, Germany (ISBN: 978-3-8443-9322-4).

#### **Invited Chapter**

Khan, MA (2013) in a Book “RNA- Nanotechnology” PAN Stanford Publishing Pvt. Ltd. Singapore. ISBN: 9789814411646 (Hardcover), 9789814411653 (eBook). <http://www.panstanford.com>

### **Peer Reviewed International Journal Articles**

1. Khan MA, Walden WE, Theil EC and Goss DJ (2017) Thermodynamic and kinetic analyses of iron response element (IRE)-mRNA binding to iron regulatory protein, IRP1. **Scientific Report**, 7(1): 8532. Doi: 10.1038/s41598-017-09093-5.
2. Khan MA and Goss DJ (2017) Kinetic analyses of phosphorylated and non-phosphorylated eIF4E binding to mRNA cap analogues. **Int. J. Biol Macromol.** Aug 8. S0141-8130(17)32052-4. [ Epub ahead of print]
3. Khan MA (2016) Iron balancing mechanism: iron regulatory element (IRE)-messenger RNA metal sensing. **BAOJ Biotechnology**, Review Article, 2(3) 1-11.
4. Khan, M.A., Ma, J., Walden W. E., Merrick, W.C., Theil, E.C., and Goss D.J. (2014). Rapid Kinetics of Iron Responsive Element (IRE) RNA/Iron Regulatory Protein1 and IRE-RNA/eIF4F Complexes Respond Differently to Metal Ions. **Nucleic Acid Research**, 42(10) 6567-6577.

5. Ma, J., Haldar, S., Khan, M.A., Sharma, S., Merrick, W.C., Theil, E.C., and Goss, D.J. (2012). Fe<sup>2+</sup>/IRE-RNA interactions have opposite effects on eIF4F and IRP protein/mRNA binding for metal-metabolite control of protein synthesis. ***Proceedings of the National Academy of Sciences (PNAS) USA*** 109(22) 8417-8422.
6. Khan, M.A. and Goss, D.J. (2012) Poly(A)-binding protein increases the binding affinity and kinetic rates of viral protein linked to genome (VPg) interaction with translation initiation factors eIFiso4F and eIFiso4F-4B complex. ***Biochemistry*** 51(7), 1388-95.
7. Ecevit, O., Khan, M.A. and Goss D.J. (2010) Kinetic analysis of B/HLH/Z transcription factors c-Myc/Max/Mad with cognate DNA. ***Biochemistry*** 49(12): 2627-35.
8. Yumak, H., Khan, M.A., and Goss D.J. (2010). Poly(A)-tail affects Equilibrium and Thermodynamic Behavior of Tobacco Etch Virus mRNA with Translation Initiation factors eIF4F, eIF4B and PABP. ***Gene Regulatory Mechanisms-BBA*** 1799(9), 653-658.
9. Khan, M.A., Walden, W.E., Goss D.J. and Theil, E.C. (2009) Direct Fe<sup>2+</sup> Sensing by Iron Responsive Messenger RNA-Repressor Complexes Weakens Binding. ***J. Biol. Chem.*** 284(44), 30122-30128.
10. Khan, M.A., Yumak, H. and Goss D.J. (2009). Kinetic Mechanism for the Binding of eIF4F and tobacco etch virus Internal Ribosome Entry Site RNA: Effects of eIF4B and Poly A Binding Protein. ***J. Biol. Chem.*** 284(51), 35461-70.
11. Baldwin, A., Khan, M.A., Tumer, N.E., Goss, D.J. and Friedland, D.E. (2009) Characterization of pokeweed antiviral protein binding to mRNA cap analogs: competition with nucleotides and enhancement by translation initiation factor iso4G. ***Gene Regulatory Mechanisms-BBA***, 1789, 109-116.
12. Khan, M.A., Miyoshi, H., Gallie D.R. and Goss D.J. (2008) Potyvirus genome-linked protein, VPg, directly affects wheat germ *in vitro* translation: Interactions with translation initiation factors eIF4F and eIFiso4F. ***J. Biol. Chem.*** 283(3), 1340-1349.
13. Khan, M.A., Yumak, H., Gallie, D.R. and Goss D.J. (2008). Effects of poly(A)-binding protein on the interactions of translation initiation factor eIF4F and eIF4F-4B with internal ribosome entry site (IRES) of tobacco etch virus RNA. ***Gene Regulatory Mechanisms-BBA***, 1779, 622-627.
14. Khan, M.A., Miyoshi, H., Ray, S., Natsuaki, T., Suehiro, N., and Goss, D.J. (2006) Interaction of Genome-linked Protein (VPg) of Turnip Mosaic Virus (TuMV) with Translation Initiation Factors eIFiso4E and eIFiso4F. ***J. Biol. Chem.*** 281 (38), 28002-28010.
15. Ray, S., Yumak, H., Domashevskiy, A., Khan, M.A., Gallie, D.R. and Goss D.J. (2006). Tobacco etch virus mRNA preferentially binds eukaryotic initiation factor (eIF)4G rather than (eIF)iso4G. ***J. Biol. Chem.*** 281 (47), 35826-35834.
16. Khan, M.A. and Goss, D.J. (2005) Translation Initiation factor (eIF) 4B affects the Rates of binding of the mRNA m<sup>7</sup>G cap analogue to eIFiso4F and eIFiso4F.PABP. ***Biochemistry*** 44, 4510-4516.
17. Khan, M.A. and Goss, D.J. (2004) Phosphorylation States of Translational Initiation factors (eIFs) affect mRNA Cap-Binding. ***Biochemistry*** 43, 9092-9097.
18. Khan, M.A., Mustafa, J. and Musarrat, J. (2003) Mechanism of DNA strand breakage induced by photosensitized tetracycline-Cu (II) complex. ***Mutation Research***, 525(1)109-119.
19. Khan, M.A. and Musarrat, J. (2003) Interactions of tetracyclines and its derivatives with DNA *in vitro* in presence of metal ions. ***Int. J. Biol. Macromolecule***, 33 (1-3) 49-56.
20. Tayyab, S., Khan, N.J. Khan, M.A. and Kumar, Y. (2003) Behavior of various mammalian albumins towards bilirubin binding and photochemical properties of different bilirubin-albumin complexes. ***Int. J. Biol. Macromolecule***, 31, 187-193.
21. Khan, M.A., Muzammil, S. and Musarrat, J. (2002) Differential binding of tetracyclines with serum albumin and induced structural alterations in drug bound protein. ***Int. J. Biol. Macromolecule***, 30(5), 243.

22. Khan, M.A. and Musarrat, J. (2002) Tetracycline-Cu (II) photo-induced degradation of serum albumin. *Comp. Biochem. Physiol. C Toxicol Pharmacol.* 131 (4) 439-446.
23. Khan, M.A., Kumar, Y. and Tayyab, S. (2002) Bilirubin binding properties of pigeon serum albumin and its comparison with human serum albumin. *Int. J. Biol. Macromolecule*, 30: 171-178.
24. Jaiswal, R., Khan, M.A. and Musarrat, J. (2002) Photosensitized paraquat-induced structural alterations and free radical mediated fragmentation of serum albumin. *J. Photochem. Photobiol.* 67(3), 163-170.
25. Khan, M.A., Muzammil, S. and Musarrat, J. (1998) "Interaction of photosensitized tetracycline with serum albumin" *Biochem. Mol. Biol. Int.*, 46, 943-950.

### Abstracts

1. Ma, J., Khan, M.A., Merrick, W.C., Theil, E.C. and Goss, D.J. (2013). Mechanism of activator (eIF4F) and suppressor (IRP) binding to iron responsive element mRNA. *The FASEB Journal April 9, 27: 551.8.*
2. Ma, J., Khan, M.A., Merrick, W.C., Halder, S., Theil, E.C. and Goss, D.J. (2012). Iron induced eukaryotic initiation factor/mRNA binding affinity change. *The FASEB Journal March 29, 26: 947.1.*
3. Khan, M.A., Ma, J., Halder, S., Theil, E.C. and Goss D.J. (2011). Iron Response Element (IRE) Riboswitches from Different mRNAs Selectively Influence Repressor Protein (IRP1) Binding Kinetics and Metal Ion Responses. *Proceedings of the 24<sup>th</sup> Annual International Symposium on the RNA Structure and Function: A New frontier in Biomedical Research*, Center for study of Gene Structure and Function, Hunter College, City University of New York and Weill Cornell Medical College Clinical & Translational Science Center, New York, Jan 21.
4. Ma, J., Khan, M.A., Merrick, W.C., Halder, S., Theil, E.C. and Goss, D.J. (2011). The interaction between eIF4F and iron response protein with IRE-mRNA. *The FASEB Journal (Suppl.) 25: 703.2.*
5. Ma, J., Khan, M.A., Merrick, W.C., Halder, S., Theil, E.C. and Goss D.J. (2011). Interaction between eukaryotic initiation factors and IRE/IRP system. *Proceedings of the 24<sup>th</sup> Annual International Symposium on the RNA Structure and Function: A New frontier in Biomedical Research*, Center for study of Gene Structure & Function, Hunter College, City University of New York and Weill Cornell Medical College Clinical & Translational Science Center, New York, Jan 21.
6. Sharma, D.S., Banerjee, B., Khan, M.A. and Goss D.J. (2011). A comparative study of cap-independent translation mechanism in barley yellow dwarf virus and tobacco etch virus. *Proceedings of the 24<sup>th</sup> Annual International Symposium on the RNA Structure and Function: A New frontier in Biomedical Research*, Center for study of Gene Structure and Function, Hunter College, City University of New York and Weill Cornell Medical College Clinical & Translational Science Center, New York, Jan 21.
7. Khan, M.A., Ma, J., Halder, S., Theil, E.C. and Goss D.J. (2010). Probing the Iron Switch in mRNA: Interactions of Iron Response Protein with IRE-mRNA. *Proceedings of the 15<sup>th</sup> Conference on Translational Control*. Cold Spring Harbor Laboratory, New York.
8. Khan, M.A., Walden, W.E., Theil, E.C. and Goss D.J. (2010) Kinetic analysis of Iron Responsive Element (IRE) mRNA with Iron Regulatory Protein (IRP1). *The FASEB Journal*, 499.7.
9. Khan, M.A. and Goss, D.J. (2010) Kinetic Analysis for the Interaction of Initiation Factors (eIFs) with Tobacco Etch Virus Internal Ribosome Entry Site RNA. *Proceedings of the 15<sup>th</sup> Annual Meeting of RNA Society*, Seattle, USA.

10. **Khan, M.A.**, Walden, W.E., Theil, E.C. and Goss D.J. (2009) Selective decrease in regulatory iron response protein 1 (IRP1) binding to mRNA iron response element (IRE). *The FASEB Journal*, 22(1), 998.1.
11. **Khan, M.A.**, Gallie D.R. and Goss D.J. (2008) Poly(A)-binding protein affects the kinetics of tobacco etch virus pseudoknot RNA binding to translation initiation factor eIF4F. *The FASEB Journal*, 22(1), 998.1.
12. Goss, D.J., **Khan, M.A.**, Miyoshi, H. and Gallie, D.R. (2008) The role of potyvirus genome linked protein, VPg, in cap-independent translation: interactions with initiation factors and IRES RNA. *Proceedings of the 13<sup>th</sup> Conference on Translational Control*. Cold Spring Harbor Laboratory, New York.
13. Goss, D.J. **Khan, M.A.** Domashevskiy, A. and Yumak, H. (2008) Biophysical insights into the mechanism of viral protein synthesis. *Proceedings of the 40<sup>th</sup> American chemical society-middle atlantic regional meeting*, New York.
14. **Khan, M.A.**, Miyoshi, H. and Goss D.J. (2007) Translation Initiation Factors eIF4F and eIFiso4F Interacts Differently with Potyvirus Genome-Linked Protein, VPg". *The FASEB Journal*, April 21(5), 641.5.
15. **Khan, M.A.**, Ray, S., Domashevskiy, Yumak, H., Gallie, D.R., Miyoshi, H. and Goss, D.J. (2006) New Insights into the Mechanism of Plant TEV Virus protein Synthesis. *Proceedings of the 11<sup>th</sup> Conference on Translational Control*, Pg 177. Cold Spring Harbor Laboratory, New York.
16. **Khan, M.A.**, Miyoshi, H., Ray, S., Natsuaki, T., Suehiro, N. and Goss D.J. (2006) Interaction of genome-linked protein (VPg) of turnip mosaic virus (TuMV) with translation initiation factors eIFiso4E and eIFiso4G. *The FASEB Journal*, 20(4), 100.6.
17. Ray, S., Domashevskiy, A., Yumak, H., **Khan, M.A.**, Gallie, D.R. and Goss D.J. (2006) Tobacco etch virus mRNA preferentially binds eukaryotic initiation factor (eIF)4G rather than (eIF)iso4G. *The FASEB Journal*, 20(4), 100.7.
18. **Khan, M.A.**, and Goss, D.J. (2005) Translation Initiation factor (eIF) 4B affects the Rates of binding of the mRNA m<sup>7</sup>G cap analogue to eIFiso4F and eIFiso4F·PABP: Stopped-Flow Kinetic Studies. *Biophysical Journal* (supplement).
19. **Khan, M.A.**, and Goss, D.J. (2004) Functional Effects of *in vitro* Phosphorylation of Translational Initiation Factors. *Proceedings of the 9<sup>th</sup> Conference on Translational Control*. Cold Spring Harbor Laboratory, New York.
20. **Khan, M.A.**, and Goss, D.J. (2004) Phosphorylation States of Translational Initiation factors (eIFs) affect mRNA Cap-Binding. *Biophysical Journal* (supplement), 86(1), 316a.
21. Khan, N.J. **Khan, M.A.**, Kumar, Y. and Tayyab, S. (2002) Binding of bilirubin to different mammalian albumins and its effect on photochemical reaction. *Proceedings of the 9<sup>th</sup> APCCB and ACBI*, New Delhi, India.
22. Zaidi, S, Singh, B.R., **Khan, M.A.** and Musarrat, J. (2002) In vitro assessment of the genotoxic potential of certain herbicides. *Proceedings of the 4<sup>th</sup> Indian Agricultural Scientists and Farmer's Congress*, Ch. Charan Singh University, Meerut, U.P., India.
23. **Khan, M.A.**, Kumar, Y. and Tayyab, S.(2001) Bilirubin binding properties of pigeon serum albumin and its comparison with human serum albumin. *Proceedings of the 89<sup>th</sup> Indian Science Congress*, Lucknow, U.P., India.
24. **Khan, M.A.** and Musarrat, J. (2001) Mechanism of DNA breakage induced by tetracycline-Cu(II) complex upon photosensitization: Role of cuprous ion and oxygen free radicals. *Proceedings of National symposium on stability and stabilization of biomolecules*, Biotechnology, A.M.U. Aligarh, India.
25. **Khan, M.A.** and Musarrat, J. (2000) Strand scission in DNA induced with tetracycline-Cu(II) complex upon photosensitization. *Proceedings of the 88<sup>th</sup> Indian Science Congress*, IARI, PUSA, New Delhi, India.

26. **Khan, M.A.**, Muzammil, S. and Musarrat, J. (1999) Interactions of tetracycline and its derivatives with calf thymus DNA. Proceedings of the 68<sup>th</sup> Annual Meeting of the Society of Biological Chemist, I.I.Sc., Bangalore, India.
27. **Khan, M.A.**, Muzammil, S. and Musarrat, J. (1998) Protein fluorescence quenching and free radical generation with photosensitized tetracycline. *Proceedings of the 6<sup>th</sup> annual Meeting of the Society of Biological Chemist*, J.N.U., New Delhi, India.
28. **Khan, M.A.** and Musarrat, J. (1997) Studies on the binding and photoinduced degradation of serum albumin with tetracycline. *Proceeding of the 66<sup>th</sup> Annual Meeting of the Society of Biological Chemist*, Andhra University, Visakhapatnam, India.
29. **Khan, M.A.** Khan, M.A., Khan, R.H. and Siddique, S. (1996) pH dependence of lectin-carbohydrate interactions” *Proceedings of National Symposium on Molecular and Cellular Biophysics and 23<sup>rd</sup> Annual Meeting of Indian Biophysical Society*, AIIMS and JNU, New Delhi, India.

#### **Meeting/Conference/Symposium/Workshop Attended**

1. 2017- The International Conference on Physical and Life Sciences, organized by the Society for Academic Research, Roosevelt hotel, Manhattan, New York, NY, USA, July 24.
2. 2011- 24<sup>nd</sup> Annual International Symposium, *RNA Structure and Function: A New Frontier in Biomedical Research*, Center for study of Gene Structure and Function, Hunter College, City University of New York and Weill Cornell Medical College Clinical & Translational Science Center, New York, Jan 21.
3. 2010- 15<sup>th</sup> Annual RNA Society Meeting, Seattle, Washington, U.S.A. June 22-26.
4. 2010- American Society for Biochemistry and Molecular Biology (*Experimental Biology*) annual meeting, Anaheim, California, U.S.A. April 24-28.
5. 2009- American Society for Biochemistry and Molecular Biology (*Experimental Biology*) annual meeting, New Orleans, Louisiana, U.S.A. April 18-22.
6. 2009- Workshop on grant writing and the “*Biophysical techniques used in the study of proteins-protein and protein-RNA interactions*”. Sponsored by the NIH, MCRI, Gene center, CUNY, USA, June 20-July 24.
7. 2009- 22<sup>nd</sup> Annual International Symposium, *Translational Cancer Research*, Center for study of Gene Structure and Function, Hunter College, City University of New York and Weill Cornell Medical College Clinical & Translational Science Center, New York, Jan 22.
8. 2008- American Society for Biochemistry and Molecular Biology (*Experimental Biology*) annual meeting, San Diego, California, U.S.A. April 5-9.
9. 2008- 13<sup>th</sup> Conference on Translational Control. Cold Spring Harbor Symposium, held at Cold Spring Harbor Laboratory, New York, Sept 3-7.
10. 2008- 40<sup>th</sup> American chemical society-middle atlantic regional meeting. ACS meeting, held at Queensborough community college, bayside, Queens, New York. May 17-20.
11. 2008- 21<sup>st</sup> Annual International Symposium: *Frontiers of Nanotechnology and Biotechnology: Integration and Invention*, Center for study of Gene Structure and Function Hunter College, City University of New York, Jan 18.
12. 2007- American Society for Biochemistry and Molecular Biology (*Experimental Biology*) annual meeting, Washington, DC, U.S.A. April 28-May 2.
13. 2006- 11<sup>th</sup> Conference on Translational Control. Cold Spring Harbor Symposium, held at Cold Spring Harbor Laboratory, New York, Sept 7-12.
14. 2006- American Society for Biochemistry and Molecular Biology (*Experimental Biology*) annual meeting, San Francisco, CA, U.S.A. April 1-5.
15. 2005- 49<sup>th</sup> Annual meeting of Biophysical Society, Long Beach, California, U.S.A. Feb 12-16.
16. 2004- 9<sup>th</sup> Conference on Translational Control. Cold Spring Harbor Symposium, Cold Spring Harbor Laboratory Meeting, New York, Sept 7-12.

17. 2004- 48<sup>th</sup> Annual meeting of Biophysical Society, Baltimore, U.S.A. Feb 14-18.
18. 2002- 9<sup>th</sup> APCCB and 28<sup>th</sup> Annual conference of ACBI, held at New Delhi, India, March 9-14.
19. 2002- 4<sup>th</sup> Indian Agricultural Scientists and Farmer's Congress held at Ch. Charan Singh University, Meerut, U.P., India
20. 2001- 89<sup>th</sup> Indian Science Congress held at Lucknow, U.P., India
21. 2001- National symposium on stability and stabilization of biomolecules held at Interdisciplinary Biotechnology unit, A.M.U. Aligarh, India, March 13-14.
22. 2000- 88<sup>th</sup> Indian Science Congress held at IARI, PUSA, New Delhi, India.
23. 2000- "National Science Day Programme" sponsored by DBT, Ministry of Science & Technology, Government of India, organized by the Interdisciplinary Biotechnology Unit, AMU, Aligarh, India, Feb 28.
24. 1999- 68<sup>th</sup> Annual Meeting of the Society of Biological Chemist, held at I.I.Sc., Bangalore, India.
25. 1999- Workshop on "Bioinformatics in the 21<sup>st</sup> Century" sponsored by DBT, Ministry of Science & Technology, Government of India, organized by the Distributed Information Sub-Centre, AMU, Aligarh, India, Oct 26-28.
26. 1999- National Science Day Programme sponsored by DBT, Ministry of Science & Technology, Government of India, organized by the Interdisciplinary Biotechnology Unit, AMU, Aligarh, India, Feb 28.
27. 1998- 67<sup>th</sup> annual Meeting of the Society of Biological Chemist, India held at J.N.U., New Delhi, India.
28. 1998- National Science Day Programme sponsored by DBT, Ministry of Science & Technology, Government of India, organized by the Interdisciplinary Biotechnology Unit, AMU, Aligarh, India, Feb 28.
29. 1997- 66<sup>th</sup> Annual Meeting of the Society of Biological Chemist, India, held at Andhra University, Visakhapatnam, India, Dec 22-24.
30. 1996- National Symposium on Molecular and Cellular Biophysics and 23<sup>rd</sup> Annual Meeting of Indian Biophysical Society held at AIIMS and JNU, New Delhi, India, Feb 18-21.
31. 1993- Short Term Technical Training on "Some recent techniques used in the study of peptides, proteins and enzymes". Sponsored by the Department of Biotechnology, Government of India at Interdisciplinary Biotechnology Unit, AMU, Aligarh, India.

### Research Interest

#### **Mechanism of Gene Regulation of Protein synthesis, Iron Metabolism and RNA Biochemistry:**

Iron deficiency and overload are both major public health problems throughout the world. About 2.0 billion people in the world are suffered from iron related disorder. About 21% population in the Kingdom of Saudi Arabia are suffering from iron related diseases. High level of iron and iron regulatory protein found in the cells of Alzheimer's, Parkinson's, Diabetes, Cancer, Tuberculosis and Thalassemia. We are interested in understanding how regulation of gene expression via IRP/IRE-mRNA interactions contributes to an organism ability to respond to iron, alterations in iron metabolism due to host/pathogen interaction and to changes in iron metabolism which occur during development, differentiation and disease. IRE-mRNAs consist of 28-30 nucleotides and can fold into a conserved stem and loop structure. IREs have been found in several other mRNAs, and it is now known that IRE-IRP interactions mediate regulation of the synthesis of a number of proteins involved with iron metabolism. Thus IRP are central regulators of iron in human cells. We have first time shown (Khan, M.A. et al. *J. Biol. Chem.*, 2009), the mechanism of dissociation of iron regulatory protein (IRP)/iron responsive element (IRE-mRNA) complexes



and showed  $\text{Fe}^{2+}$  destabilizes the complex, acting as riboswitches for the gene regulation of iron homeostasis. Maintaining the proper amount of iron is a challenge for everyone. Therefore, the studies on iron regulation will have useful outcome for the human population suffering from iron diseases. To gain insight into the dynamic process of iron regulation and mechanism of IRE/IRP binding, we have further examined the binding mechanism of initiation factors and IRE-mRNA (Jia et al. PNAS 2012) and kinetic of IRE-mRNA/IRP to measure the association and dissociation rate constant for two IRE-RNA and riboswitches of two IRE mRNA in the presence of metal ion (Khan et al., 2017, Sci Report; 2014, NAR). Our results leading to research on designer drug/chemicals that manipulate mRNA and make novel iron chelators that can remove the iron from ferritin safely and quickly for diseases such as for Sickle Cell Anemia, Thalassemia, and Hereditary Hemochromatosis.

Other research project in my laboratory on the cap-independent viral translational process (from plants to humans), we employed plant viruses as easy-to-use model systems to provide basic understanding of how viruses express genes and replicate. Because of similarities in translation and replication strategies across kingdoms, this knowledge may be relevant to major human viruses such as hepatitis A and C viruses, heart disease encephalomyocarditis (EMCV), polio, foot, and mouth diseases, common cold and dengue. In addition to cap-independent translation of TEV, TuMV through IRES, TEV/TuMV also contains a virus encoded protein, VPg, covalently attached to 5'-terminus. We have shown first time involvement of VPg in viral replication. This new finding has been recognized by the faculty of 1000 Biology Scientist. Recently we have shown the effects of PABP on the binding affinity and kinetics of eIFiso4F (Khan & Goss, Biochemistry, 2012). Using biochemistry, molecular biology and biophysical methods to study nucleic acid-protein, protein-protein interactions and macromolecular assembly of various protein synthesis translation initiation factors from human and wheat germ. We are interesting in mechanisms of assembly and how equilibria, thermodynamic and kinetics influence the final composition of assembly complexes and ultimately biological function. Experiments are aimed at determining the detailed function of proteins and how they recognize nucleic acids. These processes are studied by steady-state and life-time fluorescence measurements, rapid scanning stopped-flow and circular dichroism. Detailed quantitative measurements of these biological processes lead to elucidation of molecular mechanisms and how these processes can be regulated.