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Present Position:

J C Bose National Fellow, Centre for Cellular and Molecular Biology, Hyderabad

Adjunct Professor, RMIT University, Melbourne, Australia (2016-2019)
(an honorary position)

Brief Chronology of Employment:

Director, Centre for Cellular and Molecular Biology (CCMB), Hyderabad
(Nov. 2009-Jan. 2016)

Director (Additional Charge)**,** National Geophysical Research Institute, Hyderabad
(Mar. 2015 - Jan 2016)

Adjunct Professor, RMIT University, Melbourne, Australia (2016-2019)
(an honorary position)

Scientist G (Deputy Director), Centre for Cellular and Molecular Biology, Hyderabad
(2001-2009)

Visiting Professor, Institute for Protein Research, Osaka University, Osaka, **Japan**
(2001)

Scientist F (Deputy Director) Centre for Cellular and Molecular Biology, Hyderabad
(1996-2001)

Visiting Scientist, University of Texas Medical Branch, Galveston, USA (2001)

Visiting Professor, Science University of Tokyo, Noda, Tokyo, **Japan** (1996)

Scientist E -II, Centre for Cellular and Molecular Biology, Hyderabad (1991-1996)
(Merit Promotion, EI to EII)

Visiting Associate, National Eye Institute, NIH, Bethesda, MD, **USA** (1990-1992)

Scientist-E -I, Centre for Cellular and Molecular Biology, Hyderabad (1988- 1991) (Merit Promotion, C to EI)

Scientist-C, Centre for Cellular and Molecular Biology, Hyderabad (1984-1988)

Date of Birth: 19 January, 1954

Place of Birth: Huzurabad, Telengana

Education:

B.Sc., (Botany, Zoology and Chemistry) Osmania University, Hyderabad, India (*college first), 1975*

M.Sc., (Chemistry) Kakatiya University, Warangal, India *(Distinction), 1977*

Ph.D., University of Hyderabad, Hyderabad, *1984*
"Photoacoustic Spectroscopy of Chemical and Biological Systems"

Teaching:

Number of PhD students: 19 completed, 3 presently working

Number of Post Doctoral Fellows trained: 13

Number of projects students (M.Sc.): over 70

Have been teaching courses for PhD students as per Jawaharlal Nehru University requirements:

1982-1990	i) Molecular Spectroscopy for Biological applications, ii) Thermodynamics
1992-2000	Protein structure and function
2000- current	i) Biological Macromolecules ii) Nanobiology

Research Interests:

Molecular Biology and Biophysics, Photoacoustic Spectroscopy, Protein folding and molecular chaperones in health and disease; role of heat shock proteins in gene expression, cell cycle, differentiation and apoptosis

Applied Research: DNA based diagnostics, drug delivery, microfluidis & nanobiology.

A few important contributions:

i) Basic Research:

1. Development of Photoacoustic Spectroscopy for chemical and biological systems such as petroleum cracking catalysts, solid state photochemistry and mode of action of quinoline class of anti-malarial drugs etc.

2. *In situ* spectroscopy of intact eye lens: Cataract and UV light connection

3. Smoke and cataract connection: compromised Na^+/K^+ pump.

4. Development of "Red Edge Excitation Shift (REES)" for intact biological systems such as eye lens and membranes. This approach is subsequently extensively used (also called "wavelength selective spectroscopy" in some latter publications)

5. Demonstration of Chaperone-like activity of alpha-crystallin against photo-aggregation of gamma-crystallin.

6. Demonstration of structural perturbation leading to enhanced activity of alpha-crystallin, which was shown to be a general phenomenon with other small heat shock proteins. (This may be due to the functional requirement, since they need to function at non-permissible temperatures).

7. Genetic Engineering of chimeric alpha-crystallins with significantly higher activity; one chimeric protein patented for potential therapeutic use.

8. Demonstration of high affinity copper binding of small heat shock proteins; role in redox silencing and pathology.

ii) Translational / Applied Research:

9. Developed a multi-parametric PAS approach to discriminate tea samples for Hindustan Lever. (during 1990s)

10. Developed a method for large scale production of an industrially important peptide as a fusion protein using one of the heat shock proteins, for Celestial Biolabs Ltd. (2004-5)

11. Development of DNA based diagnostic chip for ophthalmic infections; commercialised by Xcyton Diagnostics Ltd. This product is recognised as the "**Product of the Year"** (2008) and received "**Asia Pacific Biotechnology Award**" for the product of unmet need in the Asia Pacific Region (2009).

12. Development of DNA based diagnostic chip for septicaemia and antibiotic resistance. Completed the product development with Xcyton Diagnostics Ltd.

Current Translational research projects on hand:

1. Development of a new, more efficient, compound for photodynamic therapy. We have patented one molecule; an improved version is being patented. Pre-clinical studies are in progress. Effectively treated xenograft with no observable histopathalogical changes in other vital organs. This PDT molecule can also be developed for treating AMD.

2. Development of a very effective drug candidate for retinoblastoma. Cell culture and in vivo studies carried out so far gave excellent results with complete resolution of xenograft. We are obtaining an animal model for Retinoblastoma for final studies before initiating clinical studies.

3. Developing a smart nanoparticle system for drug delivery to anterior segment of the eye. This gelatine-based nanoparticle system anchors to cornea to increase residency time, inhibits inflammation and releases anti fungal agent depending on the severity of the infection. All animal studies have proven to be safe and effective in resolving fungal keratitis.

4. Developing paper-microfluidic devices for i) detecting pregnancy in cattle; ii) alternate method for measuring Erythrocyte Sedimentation Rate (ESR); iii) blood typing

In addition, currently mentoring a few young colleagues in the areas of point-of-care diagnostics, paper microfluidics, stem cells and nano technology.

Honors & Other Recognition:

Our DNA based diagnostic chip for ophthalmic infections, commercialized by Xcyton Diagnostics Ltd., is recognized as the ***"Product of the Year"*** (2008) and received ***"Asia Pacific Biotechnology Award"*** for the **product of unmet need** in the Asia Pacific Region (2009).

National:

Life Time Achievement Award (Felicitation by the Chief Minister, on the occasion of A P Science Congress, Andhra Pradesh Akademi of Sciences, Tirupati) (2016)

Bireswar Chakrabarti Oration, ARVO-India chapter, 2015

Telangana State Award (on the occasion of the first "Telangana State formation Day Celebrations", 2 June 2015)**,** Government of Telangana, Hyderabad (2015)

Eminent Educationist Award, The Indus Foundation, Hyderabad (2014)

Visishta Puraskaram, Ramineni Foundation-USA (2014)

Doctor of Science (*Honoris Causa*), Kakatiya University (2014)

Bires Chandra Guha Memorial Lecture Award (2014),
Indian National Science Academy (INSA)

Hon. Fellowship, Association Of Biotechnology and Pharmacy (2012)

J C Bose National Fellowship, Dept. of Science & Technology, Govt. of India (2011)

The State Intellectual's Honour-The Great Son of the Soil (2010)

Raman Fellow (2001)

Ranbaxy Award for Basic Medical Sciences (2000)

Shanti Swarup Bhatnagar Award (1999),

Member of Guha Research Conference (1998)

Sreenivasaya Memorial Award 1996, The Society of Biological Chemists (India)

Young Scientist Award of the Indian Association for Radiation Protection, 1990.

Outstanding Young Person Award of Secunderabad Jaycees, 1986.

Young Scientist Award of the Andhra Pradesh Akademi of Sciences, 1982.

President, Society of Biological Chemists (India) (2015-2016)

President, Telangana Academy of Sciences, Hyderabad (2015-17)

President, A P Akademi of Sciences, Hyderabad (2012-15)

President, Indian Biophysical Society (2009-2011)

Chairman, Governing Body, Indo-American Cancer Research Foundation, Hyderabad, (2014-)

Vice-President, Society of Biological Chemists (India) (2013-2015)

Member, National Committee of IUPAB, INSA (2012-2016)

Member, Executive Council, Indian National Science Academy (2009-2012)

Member, Sectional Committee, INSA (2004-2006; 2013-2016)

Convener, Sectional Committee, INSA (2016-)

International:

Rohto Award, First Asian Cataract Research Conference, Sep. 1996, **China**

Elected as Fellow, The World Academy of Sciences, **TWAS** (Previously known as The Third World Academy of Sciences)**,** (2009)

Elected as Member, Council, International Union for Pure & Applied Biophysics **(IUPAB)** 2014-17

Elected as Member, Governing Council, Asia Pacific Protein Association, Japan

Elected as Member, Council, Federation of Asian and Oceanian Biochemists and Molecular Biologists, **(FAOBMB)**

Japan Society for the Promotion of Science (JSPS) Invitation Fellowship, Japan (2004)

Adjunct Professor**,** RMIT University, Melbourne, Australia (2016-2019)

Visiting Professor, Institute for Protein Research, Osaka University, Japan (2002)

Visiting Professor, Tokyo Science University, Japan (1996)

Visiting Scientist, University of Texas Medical Branch, Texas, USA (2001)

Fellowships Professional Academies:

Fellow of Indian Academy of Sciences, Bangalore (1999)

Fellow of National Academy of Sciences, India, Allahabad (1999)

Fellow of Indian National Science Academy, New Delhi (2000)

Fellow of A.P. Akademi of Sciences (2002)

Fellow, The World Academy of Sciences (TWAS), (2009)

Honorary Fellow, Association of Biotechnology and Pharmacy (2012)

Fellow of the Telangana Academy of Sciences (2015)

Membership in professional societies:

American Association for Biochemistry and Molecular Biology (USA)

Association for Research in Vision and Ophthalmology (USA)

Indian Biophysical Society (India)

Indian Photobiology Society (India)

Society of Biological Chemists (India)

Editorial Boards:

1. Member, Editorial Advisory Board, The Open Drug Discovery Journal
2. Section Editor; BBA-Proteins and Proteomics
3. Member Editorial board: Ophthalmic Research
4. Member Editorial board: “The Open Drug Discovery Journal”
5. Member Editorial board: Indian Journal of Ophthalmology
6. Member Editorial board: Indian Journal of Biochemistry and Biophysics
7. Member Editorial board: Proceedings of Andhra Pradesh Academy of Science
8. Member Editorial Board: Computational Biology and Chemistry, Elsevier

Academic and Executive positions:

International:

Member, Council, International Union for Pure & Applied Biophysics (IUPAB) 2014-17

Member, International Advisory Committee, Asia-ARVO 2015, Japan

Member, Council, Federation of Asian and Oceanian Biochemists and Molecular Biologists, (FAOBMB)

Member, International Advisory Committee for the 13th FAOBMB Congress, 2012

Vice-President, Asian Biophysics Association (2009-2010)

Section Editor, BBA-Proteins and Proteomics

Member, Governing Council, Asia Pacific Protein Association, Japan

Japan Society for the Promotion of Science (JSPS) Invitation Fellowship (2004)

Member, International Advisory Committee, Pacific-Rim International Conference on Protein Science, April 2004 Yokohama, Japan

Visiting Professor, Institute for Protein Research, Osaka University, Japan (2002)

Visiting Professor, Tokyo Science University, Japan (1996)

Adjunct Professor**,** RMIT University, Melbourne, Australia (2016-2019)

National:

President, Telangana State Akademi of Sciences (2015)

President, Society of Biological Chemists (India) (2015-2016)

Chairman, Governing Body, Indo-American Cancer Research Foundation, Hyderabad, (2014)

Outstanding Professor, Faculty of Biological Sciences, Academy of Scientific and Innovative Research (AcSIR), New Delhi, (2014-)

Vice-President, Society of Biological Chemists (India) (2013-2015)

Member, National Committee of IUPAB, (2012-2016)

Member, Governing Council, Indian Council of Medical Research (ICMR), (2015-)

Member, Governing Council, Indian Association for the Cultivation of Science (IACS), Kolkata (2013-2016)

President, A P Akademi of Sciences, Hyderabad (2012-15)

President, Indian Biophysical Society (2009-2011)

Member, Executive Council, Indian National Science Academy (2009-2012)

Member, Sectional Committee, INSA (2004-2006; 2013-2016)

Membership in policy making committees & professional bodies

Member, Advisory Committee, The Institution of Electronics and Telecommunication Engineers, Hyderabad (2015)

Member, Governing Council, Indian Council of Medical Research, New Delhi

Member, Governing Council, Indian Association for the Cultivation of Science (IACS), Kolkata (2013-2016)

Member, Governing Council, Society for Biotechnology Incubation Centre (SBTIC), Hyderabad, 2010-2013

Member, Governing Body, Hyderabad Eye Research Foundation, Hyderabad

Chairman, Assessment Board (Biological Sciences), RAC, DRDO, New Delhi

Chairman, Selection Committee, Senior Research Fellows and Research Associates, Nehru Fellowships in Life Sciences, HRD, CSIR

Chairman, Steering committee, "A Syndromic Approach to Diagnosis of Infections: DNA macro chips for Acute Encephalitic Syndrome, Septicaemia and Antibiotic Resistance", a program of "New Millennium Indian Technology Leadership Initiative", CSIR

Member, Shanti Swarup Bhatnagar award committee –Medical Sciences, HRD, CSIR

Member, Shanti Swarup Bhatnagar award committee –Biological Sciences, HRD, CSIR

Member, CSIR Golden Jubilee Technology Awards Committee (2008)

CSIR-Governing Body-Subcommittee for network projects Dec, 2007 (co-opted / invited member)

Member, Screening and Evaluation Committee, National Awards for R&D efforts in Industry, DSIR, Government of India.

Memebr (DG's Nominee), Research Council, Indian Institute of Chemical Biology, Kolkata, 2014-16

Member, Research Council, Institute of Microbial Technology, Chandigarh (2004-2007)

Member, Research Council, Indian Institute of Chemical Biology, Calcutta (2001-2003)

Member (Director-General's nominee), Research Council, Institute of Genomics & Integrative Biology, Delhi 2007- 2010

Member, Research Council, Indian Institute of Chemical Technology, Hyderabad (2014-16)

Member, Research Council, Central Food Technological Research Institute, Mysore (2013-15)

Member, Research Advisory panel and Scientific Advisory Committee, Centre for DNA Fingerprinting and Diagnostics, Hyderabad

Member, Scientific Advisory Committee, Yashraj Biotechnology Ltd., Mumbai, 2010

Member, RAP-SAC, National Institute of Immunology, New Delhi 2010

Member, Research Advisory Committee, Hyderabad Eye Research Foundation, LVPEI, Hyderabad

Member, Research Advisory Board, Aravind Medical Research Foundation, Madurai, 2011-2014

Member, Research Advisory Board, Krishna Institute of Medical Sciences Ltd (KIMS), Secunderabad

Member, Research Advisory Board, Dr. D Swaminadhan Research Foundation (DSRF) and its institutes, 2013

Member Academic Council, Jawaharlal Nehru University, New Delhi

Member Board of Studies in Biochemistry, Kakatiya University, Warangal

Member, Board of Studies in Pharmacy, Osmania University.

Member, Board of Studies in Forensic Science, Osmania University

Member, Planning and Advisory Board, Sri Venkateswara College of Pharmacy, Hyderabad

Member, Executive Council of Osmania University, Hyderabad

Vice-Chancellor's Nominee to the Court of the University of Hyderabad, Hyderabad (2014-2017)

Member, Board of Studies in Botany (UG), Osmania University, Hyderabad

Member, Academic Council, Nizam College, Hyderabad

Member, Academic Council, LVPE-University of Hyderabad, Hyderabad

Honorary Member, Advisory Committee, R G R Siddhanthi Educational Society, Secunderabad

Member, Adhoc Committee in Biotechnology under Faculty of Technology, Osmania University, Hyderabad, 2005-2006

Member, Executive Committee for the Centre of Excellence of the Bioinformatics Centre, Madurai Kamaraj University, 2004

Member, Project Advisory Committee, Hyderabad Science City, HMDA, Hyderabad, 2014

Member, Advisory Board, Indo-Global Healthcare Summit, Hyderabad

Member, Organizing Committee of Global Cancer Summit 2014, Hyderabad

Member, National Advisory Committee, Asia-ARVO 2013, New Delhi

Member, National Advisory Committee, 39th Annual Meeting of Indian Biophysical Society (IBS 2015)

Member, Expert Committee, Indo-US Centres of Excellence in Science and Technology, Indo-US Science and Technology Forum, New Delhi

Distinguished Member, BioAsia 2010, Federation of Asian Biotech Association (FABA), Hyderabad

Chairman, Advisory Committee, National Facility for Advanced Proteomics and Protein Research, IICB, Kolkata

Member, AACR Project Implementation Committee, IICT, Hyderabad, 2012

Council Member, IERG-American Association for Research in Vision and Ophthalmology – India Chapter (IERG-ARVO-IC), Hyderabad, 2012

Member, Advisory Council, Indian Institute of Public Health, Hyderabad, 2012-

Member, Management Council, Indian Institute of Chemical Technology, Hyderabad 2012

Member, Expert Committee for National Bioscience Awards for Career Development, DBT, New Delhi

Member, Sponsored Scheme Research Committee of CSIR, CSIR, New Delhi, 2011- 2014

Member, Domain Experts Group, NMITLI project - “Implantable Phakik Lens”, CSIR, New Delhi

Member, National Advisory Committee for Multidisciplinary Advanced Research Center (MARC), JIPMER, Puducherry, 2011-2014

Expert Member, Technical Screening Committee, SBIRI, DBT, New Delhi, 2010-2012

Member, Advisory Committee for Research Development & Consultancy Cell (RDCC), Osmania University, 2010

Hon. Secretary, A P Akademi of Sciences, Hyderabad, 2010

Member, Advisory Committee, IETE Hyderabad, 2010-2011

Member, Research Advisory Board, Narayana Medical Institutions, Nellore, 2010

Member, DBT Task Force; "Biotechnology Processes and Products", Department of Biotechnology, Government of India

Member, Program Advisory Committee; "Biochemistry, Biophysics and Molecular Biology" Department of Science and Technology, Government of India

Member, Monitoring Committee, "Development of integrated micro-PCR system with *in situ* identification", New Millennium Indian Technology Leadership Initiative" program, CSIR

Member, Expert Advisory Committee, "Biomedical Electronics, Molecular Electronics/Conducting Polymer Electronics, Non-invasive and other Biosensors" Department of Science and Technology, Government of India.

Member, PRC for the project 'Development of DNA Methylation detection kit and associated instrumentation for healthcare application', Department of Science and Technology, Government of India.

Member, Project Review Committee: "Extraction and purification of purple membrane for technological development of biochip" Department of Science and Technology

Member, Project Review and Steering Group for "Investigation of Alignment and Characterization of Carbon Nanotubes for Targeted Drug Delivery and Nanosensors", Ministry of Information Technology, Government of India

Member, Steering Committee, Programme on International Collaboration in Cutting Edge Technology Areas: Botanicals, CSIR, New Delhi

Executive Council, Indian Biophysical Society, 1999-2003

Science Popularization and related activities:

As the **President** of the **Andhra Pradesh Akademi of Science** (Now **Telengana Akademi of Science**) visited several remote parts of the state and gave several public lectures and carried out different science popularization activities.

Gave several lectures on basic scientific aspects to:

i) School children
ii) Graduate and undergraduate students
iii) General public

Made a 3-part video program titled “Modern Biology: Genes and Proteins” for country wide class room program, EMRC, EFL University, 2009

Made a video film titled ***"Listening to Molecules"*** with Educational Media Research Centre, Hyderabad, for the country-wide class room programme of the University Grants Commission, Government of India.

Delivered a talk series (Five weeks) on All India Radio, titled “Cells and Molecules” in Telugu

Participated in the science programs of the "All India Radio", Doordarshan, TV9 and ETV

Resource person and judge for children’s science activities such as ‘National Children’s Science Congress’, state level science exhibitions and congress

A few recent activities:

Invited talk and interaction with students, Telangana University Research Internship Program (TRIP) activity, Telangana University, Nizamabad, 4th Apr, 2016

Invited talk and interaction with students, Inauguration of activities of Regional Centre of Telangana Academy of Science, Karimnagar, Satavahana University, Karimnagar, 23rd Feb, 2016

National Science Day Lecture, Pillalamarri District Science Forum, SVS Medical College, Mahboobnagar, 20th Feb, 2016

Interactive session with mixed group of managers, engineers and scientists, ASCI Hyderabad, 21st Aug 2015

Visit of school, college students and underprivileged children for an interactive session to create and sustain scientific temper, STARS (Society for Training Awareness Recruitment & Social Service), Hyderabad, 24th Jun, 2014.

Chief Guest, CSIR-800 Program “Farmers Awareness Meet at Kodad Village, Nalgonda, 22nd Jun, 2014

Visit by teachers of higher education for an interactive meeting, UGC Academic Staff College, Maulana Azad Urdu Univ., Hyderabad, 22nd May, 2014.

Interactive session with class X students of Sreyasso NGO, Karimnagar, 28 Jan, 2014

Interactive session with scientists, ASCI Hyderabad General Management Programme, Hyderabad, 3rd Jan, 2014.

Interactive session, Association of Lady Entrepreneurship of Andhra Pradesh (ALEAP), 5th Dec. 2013

Interactive session with science teachers from Jana Vignana Vedika, Hyderabad, 21st Nov. 2013

Interaction with scientists, Administrative Staff College of India, Hyderabad, 26th Oct. 2013.

Interactive session with M.Sc. students of KIIT, Bhubaneswar, 19th Sep. 2013.

Interactive session with scientists, ASCI, Hyderabad on 17th Sep and 28th Aug. 2013.

Interactive session with teachers, Jana Vignana Vedika teachers programme, 8th Aug. 2013.

Interactive session with teachers during KV teachers training programme, 7th Jun. 2013.

Interaction with students of School of Biotech., KIIT Univ., 3rd Feb. 2012.

Interactive session with ASCI Women scientists, 3rd Jan. 2012.

Interaction with ASCI-ISRO Sr. Scientists, 8th Jul. 2011.

Interaction with students and teachers from Madhya Pradesh 'Vigyan Manthan Yatra 2010-11 under M.P. Mission Excellence program, 2nd Dec. 2010.

Interactive session with scientists from ASCI, Hyderabad, 6th Oct. 2010.

Interaction with A P Police Academy trainees from Maldives, 5th May, 2010.

Interactive session with Middle and Senior Scientists of DST organizations, Administrative Staff College of India (ASCI), Hyderabad, 28th April, 2010.

List of a few invited (*) talks and conference presentations

Abroad

"Involvement of complement and coagulation cascade in Retinopathy of Prematurity" *Annual Meeting of Association for Research in Vision and Ophthalmology*, **Denver, Colorado USA,** 3-7 May, 2015

* Participated in the 18th Congress and General Assembly of the IUPAB as an official delegate of the INSA and to participate as a voting delegate in both extraordinary general assembly and general assembly, **Brisbane, Australia,** 3-7 Aug, 2014

* "Copper Binding and Cytoprotection: Alpha-Crystallin and other Small Heat Shock Proteins" at the ICER – The 2014 ISER Biennial meeting, **San Francisco, 20-24 July, 2014**

* "Small Heat Shock Proteins in Health and Disease" at the **Dept. of Ophthalmology, Univ of Missouri, 17-19 July, 2014**

* "Vision Research Projects at CCMB – Research studies in India" *Annual Meeting of Association for Research in Vision and Ophthalmology*, **Seattle, Washington, USA,** 5-9 May, 2013

* "Alpha-crystallin in the context of disease", Department of Ophthalmology, Eye and ENT Hospital of Fudan University, **Shanghai, China**, 18th January, 2013

* "Small heat shock proteins in health and disease"; Department of Physiology, College of Medicine, University of Tennessee, Memphis, **USA**, 17th May, 2012

* Invited talk at the 17th IUPAB International Biophysics Congress on "Reversible aggregation of copper-bound prion protein: Interaction between N-terminal and C-terminal regions", **Beijing, China**, 30 Oct – 3 Nov'11

Young Investigators Meeting (YIM), Boston; delivered a talk on "Cell Biological Aspects of α-crystallins" at John Hopkins University School of Medicine, **USA** 6-14 October, 2010

* Invited talk at the International Seminar on "Cooperation between Pacific and Asian Countries on Protein Science", *Osaka University,* **Japan**, 14th June, 2010

* Nanoparticle based drug delivery for ophthalmic applications "Nanomedicine and Cellular Engineering Symposium" *Bindley Bioscience Center, Discovery Park, Purdue University, Lafayette,* **OH USA***,* 11th June, 2009

* Role of α-crystallin in cell cycle, apoptosis and cancer *University of Colorado Denver Health Sciences Center, Aurora,* **CO, USA***,* 15th June, 2009

* Invited talk at the symposium on 'Water and Biomolecules' at **Nara, Japan** (24-25 Jan'08)

  "Life Sciences in India", *CSIR- P&G Meeting*, **Cincinnati, USA**, 30th August, 2006

* Alpha Crystallin: chaperone activity and intracellular localization, *National Eye Institute, National Institutes of Health*, **Bethesda, USA** 9th May 2005

  "Arginine delays the onset of Selenite-induced cataract and increases *in vitro* chaperone-like activity of alpha crystallin"
  Annual Meeting of Association for Research in Vision and Ophthalmology, **Ft. Lauderdale, FL, USA,** 1-5 May, 2005

* Redox-regulation, a novel mechanism: Hsp33 *Tokyo University*, **Tokyo, Japan**, April 30th, 2004

* Small heat shock proteins with chaperone activity: alpha crystallin, hsp22 and hsp33, *Institute for Protein Research, Osaka University*, **Osaka, Japan.** April 23, 2004

* Alpha B crystallin, a small heat shock protein with chaperone activity: Intracellular localization, *1st Pacific-Rim International Conference of Protein Science*, 14-18, April 2004, **Yokohama, Japan**

* Alpha crystallin: chaperone-like activity and localization *Institute for Frontier Medical Sciences, Kyoto University*, **Kyoto, Japan**, 9th April 2004

  Role of C-terminus of AQP0 during thermal-stress induced interaction with alpha crystallin. *Annual meeting of Association for Research and Vision in Ophthalmology*, **Ft. Lauderdale, Florida, USA**, May 4-8, 2003
  (presented by Dr. Swami-Mruthinti)

  Prevention of Thermal aggregation of AQP0 by alpha-crystallin, XV International Congress of Eye Research, October 6-11, 2002
  (presented by Dr. Sawmi-Mruthinti)

* Chaperone-like activity of alpha crystallin - recent developments, *Research Reactor Center, Kyoto University*, **Kyoto, Japan,** 28th March 2002

* Cataract and chaperone-like activity of alpha crystallin, *Department of Life Sciences, University of Tokyo, Komaba*, **Tokyo,Japan,** 25th March 2002

* Chaperone-like activity of alpha crystallin and its variants, *Department of Physics, School of Science, University of Tokyo, Bunkyo-ku*, **Tokyo, Japan,** 20th March, 2002

* Protein folding in health and disease; molecular chaperones, *Tokyo National Medical Center*, **Tokyo, Japan**. 19th March 2002

* Biophysical studies on the wild type and mutant alpha crystallins, Institute for *Developmental Research, Aichi Human Service Center,* **Aichi, Japan.** 8th March, 2002

* Chaperone-like activity of alpha crystallin; an eye lens protein. *Institute for Protein Research, Osaka University*, **Osaka, Japan**, 22 Feb, 2002

* Alpha-crystallin: A Molecular Chaperone. *Dept. of Human Biological Chemistry and Genetics*, **UTMB**, **Galveston, USA**, 9 July, 2001

* Alpha-crystallin helps refolding of citrate synthase and zeta-crystallin. *National Eye Institute, National Institutes of Health,* **Bethesda, USA**, 18 June, 2001

  Mutational analysis of a conserved arginine residue in human αB crystallin. *Annual meeting of Association for Research and Vision in Ophthalmology*, **Ft. Lauderdale, Florida, USA**, 29 April – 4 May, 2001

* Protein folding and molecular chaperone in health and disease. Molecular basis for lens transparency and cataract. *Dept. of Biochemistry & Molecular Biology, Medical College of Georgia*, **Augusta, USA**, 2 June, 2000

* Protein folding in health and disease and molecular chaperone. *North Shore Long Island Jewish Research Institute*, **New York, USA**, 23 May, 2000

* Chaperone like activity of α-crystallin: Cataract and desmin related myopathy. *Albert Einstein College of Medicine*, **Bronx, New York, USA,** 22 May, 2000

* Heat shock proteins. *University of Maryland*, **Baltimore, USA,** 13 May, 2000

* Structural and functional consequence of engineered αA and αB-crystallins. *National Eye Institute, National Institutes of Health*, **Bethesda, USA**, 11 May, 2000

  Trifluoroacetic induced molten globule like state of homo- and hetero-oligomers and calf eye lens of αA and αB crystallins. *Annual meeting of Association for Research and Vision in Ophthalmology*, **Ft. Lauderdale, Florida, USA**, 30 April – 5 May, 2000

* Molecular chaperone-like activity of α-crystallin. *Rockefeller University*, **New York, USA**, 28 April, 2000

* Temperature dependent chaperone-like activity of alpha-A and alpha-B Crystallin homopolymers. *American Society for Biochemistry and Molecular Biology Meeting*, **Washington, D.C.**, 16-20 May, 1999

* Differential temperature dependent chaperone-like activity of alpha-A and alpha-B crystallin homopolymers.
Annual Meeting of Association for Research in Vision and Ophthalmology, **Ft. Lauderdale, FL, USA,** 8-14 May, 1999

Enzymatic characterisation of fungal keratitis in rabbits.
Annual Meeting of Association for Research in Vision and Ophthalmology, **Ft. Lauderdale, FL, USA,** 8-14 May, 1999

* Chaperone-like activity of α-crystallin and its role in cataractogenesis.
Structural Biology Laboratory, **Daresbury, U.K**., 5 May, 1999

* Role of α-crystallin in protein folding and aggregation.
National Institute of Medical Research, **Mill Hill, U.K.,** 4 May, 1999

* Structure and chaperone-like activity of α-crystallin. *XIII International Congress of Eye Research*, **Paris, France**, 26-31 July, 1998

* Molecular chaperones in health and disease.
Pathologie Renale et Vasculaire, **INSERM U28, France**, 3 August, 1998.

* Interaction of target proteins with α-crystallin – a molecular chaperone.
National Eye Institute, National Institutes of Health, **Bethesda, MD, USA,** 21-22 May, 1998

Over expression of an alpha B-crystallin in some human cataracts?
Annual Meeting of Association for Research in Vision and Ophthalmology, **Ft. Lauderdale, FL, USA,** 10-15 May 1998

Identification of a major fragment of human alpha B-crystallin present in some cataracts.
Annual Meeting of Association for Research in Vision and Ophthalmology, **Ft. Lauderdale, FL, USA,** 10-15 May 1998

Temperature dependent changes to α, α_A and α_B-crystallins
Annual Meeting of Association for Research in Vision and Ophthalmology, **Ft. Lauderdale, FL, USA,** 10-15 May 1998

* Origin, structure and role of pigments that accumulate in the human eye lenses of India.
Annual Meeting of Association for Research in Vision and Ophthalmology, **Ft. Lauderdale, FL, USA,** 10-15 May 1998

* Alpha crystallin: Molecular chaperone-like activity.
American Society for Biochemistry and Molecular Biology Meeting, **Washington, D.C., USA**, 16-20 May, 1998

Characterization of extracellular proteases of a corneal isolate of *Aspergillus Flavus*. *Thirty First Annual Meeting of Ocular Microbiology and Immunology Group*, **San Francisco, California**, **USA**, 25 October, 1997

* Chaperone-like activity of alpha crystallin- conformational aspects of target proteins. *Department of Physics*, *University of Tokyo***, Bunkyo-ku, Tokyo, Japan,** 30th Oct, 1996

* Molecular chaperones in health and disease. *Tokyo Research Laboratories, Kyowa Hakko Kogyo Co. Ltd***, Machida city, Japan**, 29th Oct, 1996

* Cataract and chaperone-like activity of alpha crystallin. *Saitama Medical School***, Moroyama, Japan**, 25th Oct, 1996

* Alpha-crystallin: a molecular chaperone. *National Institute of Genetics***, Mishima, Japan**, 17th Oct, 1996

* Chaperone-like activity of alpha crystallin: hydrophobic and electrostatic interactions. *International Congress of Eye Research***, Yokahoma, Japan,** 29 Sep- 4 Oct, 1996.

* Molten globule state of carbonic anhydrase interacts with alpha crystallin. *First Asian Cataract Conference***, Guangzhou, China**, Sep 25-27, 1996 (Also chaired a session)

* Conformational features of chaperone-like activity of alpha crystallin. *Brigham and Women's Hospital, Harvard Medical School***, Boston USA**, 2 August 1996

Cataract and chaperone-like activity of alpha crystallin. *FASEB conference on "Protein folding in the cell",* **Saxtons River, Vermont, USA**, July 27- Aug 1, 1996

* Structural perturbation and chaperone-like activity of alpha crystallin. *CCRG meeting*, **Kona, Hawaii, USA,** Nov 15-19, 1995

* Molecular chaperones. *Biological Sciences, State University of New York*, **Manhattan, NY**,**USA,** 31st May 1995

* Chaperone-like activity of alpha crystallin. *Long Island Jewish Medical Centre, Albert Einstien College of Medicine*, **Long Island, NY, USA**, 30th May 1995

* Alpha crystallin, a molecular chaperone. *Biological Sciences, Oakland University*, **Rochester, MI**, **USA**, 24th May 1995

Rapid refolding of crystallins and chaperone-like activity of α-crystallin. *Annual Meeting of Association for Research in Vision and Ophthalmology*, **Ft. Lauderdale, FL, USA,** 14-19 May 1995

* Temperature dependent protection against thermal aggregation of Insulin and zeta crystallin.
National Eye Institute, National Institutes of Health, **Bethesda, MD**, **USA,** 11th May 1995

* *International Cooperative Cataract Research Group meeting*, **Bethesda USA**, Nov 1993

* Photoacoustic Spectroscopy of solid state samples.
World wide energy products division Motorola, **Ft. Lauderdale, Fl, USA**, May 1993

Differential protective ability of α -crystallin towards thermal and photo-aggregation of gamma-crystallin.
Annual meeting of the Association for Research in Vision and Ophthalmology, **Sarasota, Florida, USA,** May 1993

X International Congress of Eye Research, **Stressa, ITALY,** September 1992

* Lens and Cataract: a biophysical approach.
Univerite du Quebec a Trois-Rivieres, **Qubec, CANADA,** July 1992

Participated in *the first Gordon Research Conference on Photoacoustic and Photothermal phenomena*, **New London, USA**, June 1992

Reduced nucleotides and lens photodamage.
Annual meeting of the Association for Research in Vision and Ophthalmology, **Sarasota, Florida, USA**, May 1992

* Levels of reduced nucleotides and lens photodamage.
6th Congress of the US-Japan Cooperative Cataract Research Group, **Hawaii, USA,** Nov 1991.

Synchronous Scan Fluorescence: A novel approach to Study crystallins and lens.
Annual meeting of the Association for Research in Vision and Ophthalmology, **Sarasota, Florida, USA**, April 1991

Participated in the College on Neurophysics.
Trieste, ITALY, Oct-Nov 1986.

India *(partial list)*

* Invited speaker “Science & Technology for Social Good”, National Technology Day, NEIST, Jorhat, 11 May, 2016

* Invited speaker "Role of science in shaping our lives", One day symposium on the theme "Science & Society" , Indo-German Nachkontakt Association (IGNA), Goethe Zentrum and IICT, IICT Hyderabad, 30 Apr, 2016

* Keynote "Biology, Bioinformatics and Medicine: an interface", DBT sponsored training Programme on "Medical Genetics and Bioinformatics" Central University of Punjab , Bathinda, 9 Mar, 2016

* " Biology and Medicine", Chief Guest and keynote speaker, 'National level workshop on 'Recent Advances in Cell Biology and Molecular Biology', Sir Parashurambhau College, Pune , 5 Feb, 2016

* Inaugural address, International Workshop on Functional Genomics, Department of Genetics & CPMB, Osmania University, Hyderabad, 26 Oct, 2015

* Chief Guest, Annual Guntur Seshendra Sharma Memorial Lecture in Hindi, School of Humanities, Univ. of Hyderabad, 15 Oct, 2015

* Inaugural Address, 2015 NextGen Genomics, Biology, Bioinformatics and Technologies (NGBT) Conference, 1 Oct, 2015

* Chief Guest and Inaugural Address, Hands-on Nextgen Sequencing and Bioinformics Workshop, CCMB, Hyderabad 24 Sep, 2015

* Keynote Speaker and Chief Guest, a Two Day National Seminar on "Impact of Scientific Advances on Society" St. Pious X Degree & PG College for Women, Snehapuri Colony, Nacharam, Hyderabad, 18 Aug, 2015

* Guest of Honour, Inaugural function at the National Seminar on "Clinical applications of Avarana Vata", Dr BRKR Govt. Ayurveda College, Hyderabad, 30 Jul, 2015

* Bireswar Chakrabarti Oration, “Spectroscopy to Ophthalmoscopy”, ARVO-India-IERG, L V P E I, Hyderabad, 25 Jul, 2015

* Special Invitee, National Symposium “Sipra Innovative Pharma Research Awards" 2015, Hyderabad, 3 Jul, 2015

* Invited speaker and Guest of Honour, the Forum For a Better Hyderabad at ASCI, Hyderabad, 5 Jun, 2015

* "Modern Molecular Biology - Clinical opportunities" Guest lecture, Sunshine Medical Academy of Research and Training (SMART), Hyderabad, 28 May, 2015

* Inaugural address, College Day Celebrations, A V College Post Graduate Centre, Hyderabad, 7 Apr, 2015

* Inaugural address, Conference on Research Methodologies, BITS Pilani Hyderabad Campus, 3 Apr, 2015

* National Science Day Lecture, DRDO, RCI Imarat, Hyderabad, 4 Mar, 2015

* Guest of Honour at Dr Yellapragada Subba Rao Award Function, Narayana Medical College Nellore, 31 Jan, 2015

* Convocation address, Yuvaraja College, Mysore University, Mysore, 16 Jan, 2015

* Keynote speaker, 11th S T A R S Award Ceremony (American Association of Government College of Pharmacy (Bengaluru) Alumni), 17 Dec, 2014

* Key note address, inaugural function of the national seminar on “Applied Immunology”, Pingle Govt College for Women, Warangal, 19 Sep, 2014

* Plenary Lecture “Advances in Biomolecular Sciences and Analytical NMR Workshop”, Srimad Andavan Arts and Science College, Srirangam,Trichy, on 25th Aug. 2014

* Inaugural address, 19th Annual Conference, Cardiological Society of India (A P Chapter), Hyderabad, 5 Jul. 2014

* Convocation address, 20th Convocation of Kakatiya University, Warangal, 12th May, 2014

* Inaugural address, National Symposium on Human Diseases, BITS, Hyderabad, 15 Mar, 2014

* Keynote Speaker and Guest of Honour, 22nd Annual Day Celebrations, "Sri Sai Vignan Bharati College for Women", Secunderabad, 12 Mar, 2014

* Invited talk at the One Day seminar on “Integration of Teaching and Research in Biophysics at Graduate & Postgraduate Level” AIIMS, New Delhi, 11 Feb, 2014

* "Modern Biology and Medicine", Walchand College, Solapur, 20 Jan, 2014

* Inaugural address, Hemant Utsav, Abhyasa School, Hyderabad, 12 Jan, 2014

* Invited Talk “Novel functions of small heat shock proteins: copper binding and redox-silencing”, Valedictory function, Annual meeting of SBC (I) at University of Hyderabad, 5 Dec, 2013

* Valedictory Address at the State Level Masters Resource Persons Training Programme on Tracking of Comet, ISON, Hyderabad, 19 Nov, 2013

* Convocation address, St. Pious X Degree & PG College for Women, Hyderabad, 9 Nov, 2013

* "Science driven by Technology", Inaugural address, 5-Day National Workshop on Modern Instrumental Methods of Inorganic Chemical Analysis of Engineering Materials NIT, Warangal, 22 Oct, 2013

* Inaugural address, International Conference on “Emerging Trends in Biomarker Research – Prospects & Challenges”, Jawaharlal Nehru Institute of Advanced Studies, Hyderabad, 13 Sept, 2013

* Guest of Honour, Inaugural function, National Institute of Animal Biotechnology, Hyderabad 2 Sep, 2013

* “Next Generation Sequencing for Gene Screening for Breast and Ovarian Cancer” Continental Hospitals Ltd., Hyderabad, 24 Aug, 2013.

* Lecture on “Excitement of doing Science” for school children, Dr. A S Rao Awards Council, Vikas Concept School, Miyapur, Kukatpally, Hyderabad, 29 April, 2013

* Interactive session with school and college students, Indo-German – Excellence on Tour 2013, Muffakham Jah College of Engineering & Technology, Hyderabad, 26 Apr, 2013

* “Small heat shock proteins in health and disease” National Workshop on Techniques in Plant Tissue Culture and Biotechnology at OU College for Women, Koti, Hyderabad, 19 Apr, 2013

* "Distinguished Alumni Lecture", University of Hyderabad, Hyderabad, 9 Apr, 2013

* Foundation Day Lecture, Indian National Centre for Ocean Information Services, Hyderabad, 3 Feb, 2013

* Inaugural lecture, International Conference on Environment and Health Therapeutics – ICEHT-2012, S V University, Tirupati, 20 Dec, 2012

* “How do we sequence DNA: past, present and the future”, Popular Lecture Programme of Andhra Pradesh Akademi of Sciences Regional Centre, Kakatiya University 6 Nov, 2012

* Inaugural Speech, DST Training Workshop on “Coastal Aquifer Monitoring and Management”, Tirupati, 29 Aug, 2012

* “Modern Biology and Medicine”, Sri Padmavati Mahila Visva Vidyalayam, Tirupati, 29 Aug, 2012

* Chief Guest and delivered a lecture at the National Seminar “Science Colloquium – Touching New Horizons “ at Avanthi Degree & P.G. College, Hyderabad, 18 Apr, 2012

* Convocation lecture, Convocation of Chaitanya Degree & P.G. College, Warangal, 3 Mar, 2012

* Prof T R Seshadri Memorial Lecture organized by Royal Society of Chemistry (London), Deccan Section at IICT, Hyderabad, 3 Feb, 2012

* Lecture for College students at the "Indian Academy of Sciences sponsored Lecture Workshop" in Nandyal, Kurnool, 2 Feb, 2012

* Convocation address, Chaitanya Post Graduate College, Hanmakonda, 3 Mar, 2012

* "Cloning" Lecture at Ideal College of Arts & Sciences, Kakinada, 18 Feb, 2012

* Chaired a session, "Strategy and Way Forward: Research – Global importance in healthcare" at 2nd Annual Conference on Global Association of Physicians of Indian Origin (GAPIO) at Hotel Taj Krishna, Hyderabad, 5 Jan, 2012

* "Small Heat Shock Proteins and Protein Aggregation" Lecture at the Silver Jubilee Symposium and Third Annual Conference BIOEPOCH of School of Biotechnology, JNU, New Delhi, 2 Apr, 2011

* Annual Day lecture, Kavitha Memorial College Annual Day, Khammam, 24 Feb, 2011

* "Protein Folding and Disease", Chief Guest and Keynote address - National Seminar/Workshop on Diseases of Protein folding & misfolding - St. Francis College for Women, Hyderabad, 18 Feb, 2011

* “Unusual Temperature-dependent Aggregation of Copper bound Prion Protein”, 7th Asian Biophysics Association Symposium and Annual Meeting of Indian Biophysical Society, India Habitat Centre, New Delhi, 30 Jan - 2 Feb, 2011

* Inaugural Address, NIMS Annual Conference of International Academy of Pathology, Hotel Katriya, Somajiguda, Hyderabad, 9 Dec, 2010

* "Molecular Biology, protein folding and disease" J C Bose Memorial Lecture, IETE, Osmania University, Hyderabad, 3 Dec, 2010

* Inaugural lecture, National Conference on Biological Chemistry (NCBC-2010), Gitam University, Vizag, 29-30 November, 2010

TWAS 21st General Meeting, HICC, Hyderabad, 19-22 October, 2010

* Inaugural address, Workshop on “RNAi by Sigma Aldrich”, CCMB, Hyderabad, 22-24 Sep, 2010

* "Molecular Chaperones, Protein folding in Health and Disease" Key Note address at Kamineni Hospital, Hyderabad, 28 Aug, 2010

* Inaugural Lecture at the workshop on molecular modelling and drug design at University of Hyderabad, 2 Aug, 2010

* Inaugural address, 7th "Technology Led Entrepreneurship Programme (TLEP)" of HRDG, CSIR at IICT, Hyderabad, June 1, 2010

* "Creativity", Invited Speaker, Ramakrishna Mission, Kolkata, 14-15 Nov, 2009

* Foundation Day lecture "Small Heat Shock Proteins in Health and Disease" Indian Institute of Toxicology Research, Lucknow, 4 Nov, 2009

* “Biotechnology in Molecular Electronics and Nano Technology”, Kakatiya Institute of Technology, Warangal, 5 Oct, 2007

* “Novel Diagnostics for Microbial Pathogenes – Recent trends in microbial technology”, Inaugural lecture, Warangal, 5 Oct, 2007

* “Current Excitement in Biotechnology: Nano science” National Institute of Technology, Warangal, 25 Sep, 2007
* Invited Speaker, Brain storming session on “Development of platform technologies for various applications including optical sensors”. 17 Oct, 2006, DST, New Delhi (organized at INSA, New Delhi)

* Invited Speaker National workshop-cum-symposium on “Sensors and instrumentation for food processing”. 20-21 Jan, 2006, CFTRI, Mysore

* National seminar on “Molecules, interactions and design: A Biophysical Perspective”. 7-9 Jan, 2006, IICB, Kolkata

* Two-day National Conference on Biomaterials and their applications, “Biomaterial” Indian Ceramic Society, 27 Nov, 2004, Hyderabad

* Refresher Course in Chemistry, “Proteins: transcription, translation and folding” UGC-Academic Staff College, Osmania University, 15th Oct, 2004, Hyderabad

* Invited delegate, Meeting on “Consultations for Roadmap on Nanobiotechnology and its Application in Medicine and Diagnostics”. 16-17 Aug, 2004, National Institute of Immunology, New Delhi

* National Science Day Lecture "New excitement in Modern Biology: Genomics, proteomics and the future" National Remote Sensing Agency, 28 Feb, 2003, Hyderabad

* Public Lecture, National Science Day Celebration, Viveka Vardhini Hall, 28 Feb, 2003, Hyderabad

* "Biotechnology and Bioinformatics" talk for Science teachers of Kendriya Vidyalaya (from all over the country) 17 Jun, 2002, Hyderabad

* "New Excitement in Modern Biology", 90th Session of National Science Congress, "Science for School Children" special program for children, 3-7 Jan, 2003, Bangalore

* "Introduction to modern Biology: the problem of protein folding" Bharat Degree College for Women, 9 Jan, 2003, Hyderabad

* "Meet a scientist program" talk and interactive session, 11 Jan, 2003, Guntur

* "Introduction to molecular biology: genes, proteins and future possibilities". Refresher course, Academic Staff College, University of Hyderabad, Hyderabad, 30 Oct, 2002

* "α-Crystallin: a small heat shock protein with chaperone activity", The First Indian Symposium of the Protein Society – Protein Structure & Function, Indian Institute of Technology, Mumbai, 18-20 Oct, 2002

* Molecular Biology and Nano Biology, 45th Annual Technical Convention, IETE, Chandigarh, 30 Sep, 2002

* "Alpha-crystallin a small heat shock protein and a molecular chaperone", Dept. of Genetics, Osmania University, Hyderabad, 31 Dec, 2001

* "Protein folding in human health and disease", MediCiti Hospitals, Hyderabad, 30 Dec, 2001

* "Excitement in modern biology: Genes and proteins", Regional Research Laboratory, Thiruvananthapuram, 28 Dec, 2001

* "From Chemistry to genomics and proteomics", Indian Society for Analytical Science, 23rd Oct, 2001

* "Protein folding, chaperones in health and diseases". ISHG 2001, XXVI Annual Conference of the Indian Society of Human Genetics, Centre for Cellular and Molecular Biology, Hyderabad, 20-22 Feb, 2001

* "Protein folding in health and disease". Seminar on Pansophy of Biotechnology and its Applications, Avanthi Degree & PG College, Hyderabad, 20 Feb, 2001

* “Biophysical aspects of molecular chaperones”. Silver Jubilee Celebrations: One day symposium on New Horizons in Chemistry, Department of Chemistry, Kakatiya University, Warangal, 13 Feb, 2001

* “Inter-subunit interactions and chaperone-like activity of alpha-crystallin”. National Symposium on Biophysics, Indian Institute of Chemical Biology, Calcutta. 15-17 Jan, 2001

* Human genome project. Dept. of Chemistry, Ideal College of Arts & Sciences, Kakinada, 23 Dec, 2000

* “Applications of spectroscopy”. Seminar-cum-workshop on Application of Modern Analytical Techniques and Computer Aided Learning in Chemistry, Biochemistry and Allied Fields, St. Francis College for Women, Hyderabad, 29-31 Mar, 2000

* “The problem of protein folding and molecular chaperone like activity of α-crystallin”. Seminar on Current Trends in Chemical Research, Osmania University, Hyderabad, 13-15 Mar, 2000

* “Cataract and chaperone-like activity of α-crystallin”. International Symposium on cataracts – Molecular and epidemiological aspects, Chennai, Jan 31 – Feb 1, 2000

* “Chaperone-like activity of α-crystallin: A biophysical and molecular biological Study”. Satellite Symposium on Structural Biology and Molecular Recognition, Saha Institute of Nuclear Physics, Calcutta, 27-29 Sep, 1999

* “Chaperone-like activity of alpha-crystallin and its subunits”. XIII International Biophysics Congress, New Delhi, 19-24 Sep, 1999

* “Structural features of the target protein-alpha crystallin interaction”. XIII International Biophysics Congress, New Delhi, 19-24 Sep, 1999

* “Molecular chaperones: α-crystallin”. Diversity in Modern Biology: An Interdesciplinary Symposium**,** Bimal K. Bachawat Foundation for Scientific Research, University of Delhi, 21-22 Sep, 1997

* “Molecular chaperone-like activity of alpha-crystallin”, MCBN, (UNESCO)/DBT/SAOC workshop on “Cells and Molecules in Biotechnology”, Mahabalipuram, Madras, 26-29 Jan, 1997

* “Chaperone-assisted protein folding” (2 lectures). Mahabaleswar Seminar on Modern Biology, Protein folding and design, Ooty, Jan, 1997

* Chairperson 'Symposium on Chaperone activity- alpha crystallin', XI International Congress of Eye Research, New Delhi, INDIA, Nov, 1994

* IX National Symposium, Indian Photobiology Society, Hyderabad, INDIA. 4-5 Mar, 1994. (organizer)

* Indian Eye Research Group meeting, Hyderabad, INDIA, 8-9 Jan, 1994. (Organizer)

* Chairperson, "Chaperone like activity of α-crystallin". Indian Eye Research Group, Hyderabad, Jan, 1993

* "Wood smoke condensate impairs Rubidium and choline uptake in organ cultured rat lenses", 61st Annual meeting of the Society of Biological Chemists, India Hyderabad, Dec, 1992

* "Effect of ultraviolet radiation on intact eye lens", Dr.Gopal Iyengar Young Scientist Award Lecture, IARP Conference, Allahabad, 1990

* "Red edge excitation Spectroscopy of intact eye lenses". National symposium on Biophysics, Banaras Hindu University, Banaras, Feb, 1989

* PAS Methodology and instrumentation". National Workshop on Spectroscopy and Lasers, Waltair, Feb, 1989

* "Molecular Spectroscopic methods in Biology" Department of Biochemistry, Osmania University, Hyderabad**,** Feb, 1989

* *"In situ* Spectroscopy", Regional Engineering College, Warangal, Feb, 1988

* "Photoacoustic Spectroscopy – Instrumentation", The National Symposium on Instrumentation, Hyderabad, Oct, 1986

* Bioenergetics and Spectroscopy, North Eastern Hill University, Shillong**,** Dec, 1985

* "Photoacoustic Spectroscopy in Biology", XI Indian Biophysical Society Symposium, Hyderabad**,** Mar, 1984

* *Invited*

PhD students supervised:

S.No.	Name	Year	Title of thesis
1	S Chenchal Rao	1991	Molecular aspects of the eye lens proteins
2	B Raman	1997	Molecular chaperone-like activity of alpha crystallin
3	Siddhartha Datta	2000	Molecular chaperone-like activity of homo- and hetero-oligomers of αA- and αB-crystallins
4	K Rajaraman	2000	Alpha-crystallin as a molecular chaperone: conformational studies
5	L V Sivakumar	2001	Structure-function relationship of human recombinant alpha crystallin: Effect of site-directed mutations on oligomerisation and chaperone like activity
6	Shradha Goenka	2001	Stability and conformational aspects of zeta-crystallin and its interaction with alpha crystallin
7	Mohd. Waseem Akhtar	2005	Studies on the oxidative activation of a heat shock protein
8	Saloni Yatin Pasta	2005	Structure-function relationship of alpha crystallin
9	Amit Srikanth Adhikari	2006	Investigations on the chaperone activity of alpha-B crystallin *in vivo*
10	Chowdary Tirumala Kumar	2007	Structural and functional studies on mammalian heat shock protein, Hsp22
11	Md Faiz Ahmad	2008	Inter-protein interactions in amyloids
12	Devendra Singh	2008	Human small heat shock protein HSP22 and alpha-crystallin: Structural and functional aspects
13	Bhairab Nath Singh	2009	Role of alphaB-crystallin in stress and differentiation
14	Abhay Kumar Thakur	2010	Prion protein photo-oxidation, amyloidogenesis and interaction with small heat shock proteins
15	Aftab Taiyab	2010	Effect of Hsp90 inhibition on tumor cells
16	Abhishek Asthana	2013	Structural and functional studies on human HspB3
17	S Prabhu	2013	Structural and functional studies on human small heat shock protein HSPB2 and HSPB5

S.No.	Name	Year	Title of thesis
18	Abdullah Sultan	2014	Structural and functional studies on extracellular chaperones
19	Saad Mohammad Ahsan	2016	Micro/nanoparticles in ophthalmic drug delivery
20	Kranthi Kiran Akula		*In vivo* function of alphaB-crystallin
21	Suvarsha Rao		Structural and functional characterization of extracellular chaperones
22	Budnar Prashanth		αB-crystallin in neurodegenerative diseases
23	Kamakshi Dandu		Retinoblastoma: Potential drug candidates and mechanistic details

Post Doctoral Fellows Supervised:

1	K Narayanan	1990-92	Photoacoustic spectroscopy to probe intracellular localization of drugs
2	T K Suresh Kumar	1990-92	Effects of additive proline on protein refolding
3	V Trivedi	1991-93	Role of electrostatic interactions on protein
4	Debi Ghosh	1991-93	Effect of salts on the chaperone-like activity of α-crystallin
5	G Lalitha	2001	Effect of mutations of some conserved residues on the structure and chaperone properties of αA- and αB-crystallin
6	Surya Prakash	2001-03	Surface hydrophobicity of αA- and αB-crystallin
7	Ranvir Singh	2001-03	Chaperone property of ribosomes: Surface hydrophobicity of ribosomes and its effects on protein refolding
8	C Geetha	2001-03	Effects of C-terminal truncation on the structure and chaperone property of α-crystallin
9	S Mahesh	2001-03	Preparing monoclonal antibodies against αA- and αB-crystallin
10	T Anand	2002	Developing DNA-based diagnostic method

11	C S Jyothirmayi	2002-05	Screening potential point mutation in αB-crystallin involved in age-related cataract formation
12	P V Ramachandar	2003-06	Developing DNA-based diagnostic method
13	Madhuri B	2009-15	Development of novel sensitizers based on NIR dyes
14	Sunitha K	2015-	Ageing and visual impairment: role of small heat shock proteins

Project Assistants:

S.No.	Name	Project Name
1.	Priyadarshini	JC Bose Fellowship
2.	V Vani	JC Bose Fellowship
3.	Misha K R	High throughput proteomic analysis using microfluidic platform to understand wound healing mechanism (Ramalingaswami Fellowship)
4.	I Raghavendra	High throughput proteomic analysis using microfluidic platform to understand wound healing mechanism (Ramalingaswami Fellowship)
5.	Rohit Budhraja	Identification of biomarkers for risk prediction and disease progression in retinopathy of prematurity (ROP) a potentially blinding neonatal disorder
6.	D Kamakshi	JC Bose Fellowship
7.	M Sreevidya	Identification of biomarkers for risk prediction and disease progression in retinopathy of prematurity (ROP) a potentially blinding neonatal disorder

Summer students and short projects:

S. No.	Name of the Student	Year	Institute/Affiliation	Remarks
1.	Tomali Chakravarty *Purification of recombinant VEGF 121 and α-Crystallins*	2015	Madurai Kamaraj Univ , Madurai	
2.	Devanshu Mehta *Cloning, Purification, Structural and Functional Characterization of CPP-HspB5 Protein*	2015	Invertis Univ Bareilly	
3.	Bhamidipati Keerti *pH– Dependent Structural and Functional Studies on Haptoglobin*	2014	TERI University, New Delhi	
4.	A Geetika *Cloning of Human Lysozyme from COLO205 cancer cell line*	2013	JBIT, Moinabad, Hyd	
5.	M Rastogi *Role of Arginine (R21) in Structural and Functional Properties of αA-crystallin*	2013	Amity University, Lucknow	
6.	C Gowri *Effect of plasma clusterin and recombinant forms of clusterin on α-Synuclein amyloidosis*	2013	Geetam University, Visakhapatnam	
7.	Bh Keerti *Cloning of Cell penetrating αB Crystallin*	2013	TERI University, Delhi	
8.	Mayank Shukla *Use of paper microfluidic devices to determine erythrocyte migration rate and synthesis of gold nano-particle for paper-based diagnostic devices*	2013	NIT, Agartala	

S. No.	Name of the Student	Year	Institute/Affiliation	Remarks
9.	Sai Santosh Sasank Peri *3D Paper Microfluidic Device-Design, Fabrication and Applications*	2013	Gokaraju Rangaraju Engg. College, JNTU, Hyderabad	
10.	Preeti Kunchala *Denovo amyloid fibril formation of β2M: Effect of haptoglobin*	2012	Molecular and Cellular Biology University of Texas , Dallas	
11.	Trupti Togar *Expression and purification of α and β chains of an abundantly present plasma protein and their role in metabolism*	2012	IIT, Roorkee	Indian Academy of Sciences
12.	Vijay Bhaskar *Oligomerization and subunit exchange of small heat shock proteins Acr-1 and αB-crystallin*	2012	Bharathidasan University	Indian Academy of Sciences
13.	Swati Singh *CPP-TAT mediated αB-crystallin delivery into human neuroblastoma cells*	2012	Banasthali University	
14.	Vidya Tadapatri *Over-expression of α-crystallins and their engineered variants in human retinal pigment epithelium (ARPE 19) cell line: Intracellular localization and effect on cell cycle*	2012	PG College, OU	
15.	Shantanu Laddha *Non-conventional methods of fabricating elastomeric micro fluidic devices and paper micro fluidic devices: Application in immobilization of common antibodies*	2012	Priyadarshini Institute of Engineering & Technology, Nagpur	
16.	K Ramya *Structural studies on αB-crystallin*	2011	Gokaraju Rangaraju Institute of Engineering and Technology, JNTU	

S. No.	Name of the Student	Year	Institute/Affiliation	Remarks
17.	Anagha Krishnamoorthy *Mammalian cell expression of α-crystallins & their engineered variants: Testing their stability in organic solvents for nanoparticle encapsulation*	2011	University of Madras, Chennai	
18.	Pramod R *Identification of interacting partners of the small heat shock protein HspB3*	2011	PESIT, Bangalore	
19.	Amarnath R *Identification of interacting partners by using FLAG-tagged HspB2*	2011	SRM University, Chennai	
20.	Manoj Kumar Abboju *Generation of phosphorylation-mimic mutant (s19e) of alpha B-crysatllin by site-directed mutagenesis*	2010	Post Graduate College of Science, Saifabad, OU, Hyderabad	
21.	Aishwarya R *Copper binding studies on small heat shock proteins, Hsp27 and HspB3*	2010	PESIT, Bangalore	
22.	Snehalata Singh *Copper binding studies on small heat shock proteins HspB2 and HspB2del-70*	2010	Devi Ahilya Vishwavidyalaya, Indore	
23.	Heena Khatter *Structural and biophysical characterization of deletion and insertion mutants of alphaB-crystallin*	2009	School of Life Sciences, JNU, New Delhi	
24.	Amrin	2009	CRR	
25.	Brinda Somasundaram *On-column unfolding and refolding of αB-crystallin*	2009	P S G College, Coimbatore	
26.	Venkata Jayasurya Y *Assembly and calibration of a photoacoustic spectrometer*	2009	University of Hyderabad	Short project

S. No.	Name of the Student	Year	Institute/Affiliation	Remarks
27.	Sireesha Vaidya *Sub-cloning and generation of recombinant adenoviruses for RNAi sequence of αB-crystallin gene*	2008	Arora Degree & PG College, Hyderabad	Indian Academy of Sciences
28.	Kankana Burman *Site directed mutagenesis of histidine at 111 and 119 position of αB-crystallin*	2008	Allahabad Agricultural Institute, Allahabad	
29.	Nagaraju Marka *Site directed mutagenesis of histidine residues to alanine in αB-crystallin and purification of αB (H119A) crystallin protein*	2008	Govt City College, Hyderabad	
30.	Y Gauthami *Purification of HspB3 and its subunit exchange with αA-crystallin using fluorescence resonance energy transfer (FRET)*	2008	Sreenidhi Institute of Science & Technology, Hyderabad	
31.	Abhijeet Gummadevelli *Alpha-B crystallin prevents oligomycin-induced aggregation of alpha-synuclein*	2008	Johns Hopkins Medical School, USA	
32.	Kavya Guda *Learning molecular biological techniques and transfection of mammalian expression vectors*	2008	California, USA	
33.	Deepa Reddy *Generation of single mutant of αB-crystallin*	2007	Govt City College, Hyderabad	
34.	S P Preethi *Effect of sorbitol on oligomer size and polydispersity of αB-crystallin*	2007	Centre for Biotechnology, Anna Univ., Chennai	Indian Academy of Sciences
35.	Manasi Mayekar *A study of the effect of mutations on the structure stability and myloidogenic potential of β2microglobulin*	2007	IIT, Roorkee	Indian Academy of Sciences

S. No.	Name of the Student	Year	Institute/Affiliation	Remarks
36.	D Ravikanth *Cloning of site specific label (FlASH) in αA-crystallin*	2007	Govt City College, Hyderabad	
37.	P Swathi *Structure, function aspects of αBg crystalline*	2007	Osmania University	
38.	Rose Menacherry *Temperature-dependent oxidation induced oligomerization and chaperone activity of E.coli Hsp33*	2006	VIT, Vellore	Indian Academy of Sciences
39.	P Selva Kumar *Effect of some proteins on the formation of gold nano particles*	2006	University of Hyderabad	
40.	Ambika Srinivasan *Biophysical investigations of mouse full-length prion protein*	2006	VIT, Vellore	
41.	K Swrana Latha *Overexpression and purification of αB- and phosphorylation mimicking mutant αB3D-crystallin*	2006		
42.	Subhash Sista *Cloning and overexpressing alpha-crystallin and its mutant*	2006	Hyderabad	
43.	Dr. Sarad Kumar Mishra *Purification of trypsin inhibitor from seeds of atylosia sp., a wild legume*	2005	Dept of Biotechnology, DDU Gorakhpur Univ	Indian Academy of Sciences
44.	V Smitha *Over expression and purification of homogeneity of αB3D*	2005	J J College of Arts & Sc., Bharathidasan Univ	
45.	Kaushiki Sen *Studies on interaction of small heat shock proteins with cytoskeletal elements (actin)*	2004	Dept of Biochemistry, BHU, Varanasi	
46.	Surayya Taranum *Protein folding and amyloidosis*	2004	Dept of Animal Biotech., Univ of Hyderabad	Indian Academy of Sciences

S. No.	Name of the Student	Year	Institute/Affiliation	Remarks
47.	Sai Ratna Manjari *Alpha B-crystallin: A biomarker for disease diagnosis*	2004	Dept of Biochem., Univ of Madras	
48.	K Harini *Degassing of water: Effect on protein solutions*	2004	University of Madras	
49.	G Kalyani *Comparing the wild type and mutant α-crystallins with respect of quaternary structure and chaperone activity*	2004	Osmania University	
50.	Chandini Kalsy *Over-expression and purification of alpha-crystallin and its mutants*	2003	Arora Degree College, Hyderabad	Indian Academy of Sciences
51.	Sravanthi Kolla *Overexpression and purification of α-B R 120G protein; subunit exchange studies*	2003	MNRPG College, Osmania University	
52.	Madhavi S *Over expression, purification, structural characterization and subunit exchange studies of αB-crystallin protein with cysteine mutant*	2003	University College for Women, OU	
53.	Dipanwita Batabyal *Co-expression of zeta-crystallin with αB-crystallin in E.coli*	2002	Kolkata	Indian Academy of Sciences
54.	S Sankara Narayanan *Bacterial expression, purification and characterization of two mutant proteins of α-crystallin, R116C and R120G*	2002	Centre for Biotech., Anna Univ., Chennai	
55.	Deepak Dash *Effect of NADPH on enzyme activity of zeta crystallin and its complex formation with alpha crystallin*	2002	Pondicherry Univ	
56.	Esther Henry *Purification and characterization of Hsp33*	2002	Univ of Madras, Chennai	

S. No.	Name of the Student	Year	Institute/Affiliation	Remarks
57.	P V Nagesh Babu	2001		Indian Academy of Sciences
58.	Sanjay Kumar Bharti *Characterization of wild-type αB-crystallin and its P51:52A mutant*	2001	BHU, Varanasi	Indian Academy of Sciences
59.	Rahul Sharma *Purification and characterization of keratin degrading exoenzyme from microsporum gypseum strain isolated from Jabalpur*	2000	Mycology Lab, Dept of Biol Sci., Rani Durgawati University	Indian Academy of Sciences
60.	Asna Farkhunda Taj *Structural and functional consequences of mutations in αA-crystallin*	2000	REC, Warangal	
61.	I Nagalakshmi *Studies on the structure and chaperone-like activity of αB-crystallin and the mutant H119Y*	1999	Nagarjuna University	
62.	P Ramesh *Fine biochemicals information system*	1999	Madurai Kamaraj University	
63.	P Anuradha	1997	Dept of Biotech., Banasthali Vidyapith, Rajasthan	
64.	Aparna Bhaskaran	1997	Dept of Biotech., Banasthali Vidyapith, Rajasthan	
65.	A Sailaja *Refolding of denatured-reduced lysozyme at high concentrations*	1995	School o fBiotech., MKU	
66.	Gowtham S Rao *An excursion into the world of eye lens proteins*	1994	Dept of Chemistry, IIT Bombay	
67.	Nalini Kumari *Solid state spectral studies on tryptophan*	1994	Dept of Chemistry, REC, Warangal	

S. No.	Name of the Student	Year	Institute/Affiliation	Remarks
68.	C Padmaja *Design and fabrication of an experimental set up for measuring electrophysiological parameters of lens cells*	1993	Dept of Physics, Univ of Poona	
69.	D Samuel Joseph Ponraj *Application of fourier transform technique in photoacoustic spectroscopy*	1990	JNTU, Hyderabad	
70.	Susmita Sil *Synchronous scanning method in fluorescence analysis*	1990	Biophysics, Mol. Biol. & Genetics, Univ of Calcutta	
71.	Volety Srinivas *Status of hemin in aqueous solutions*	1988	JNTU, Hyderabad	
72.	P Bheema Rao *Red edge excitation effect on aromatic amino acids and intact eye lens*	1988	Dept of Chemistry, REC, Warangal	

Book Chapters:

1. Effect of light on Amyloidogenic Proteins : Nucleation and Fibril Extension, in **"Water and Biomolecules: Physical Chemistry and Life Phenomena"** Edited by K Kuwajima, Springer Science, 2009

2. Alpha-Crystallin, a small heat shock protein with diverse functions in cell survival and stress tolerance, in "**Stress Response : A Molecular Biology Approach"** Edited by A.S Sreedhar and Usha K Srinivas, Research Sign Post, 2006

Guest Editor:

"Protein Folding",
Proceedings of the Indian National Science Academy (Part-A),
Volume 68, issue 4, July 2002

Guest Editorial:

"Unwrapping the Human Genome"
Indian J. of Ophthalmology, Volume 49, issue 1, March 2001

"Science : A Tool for Social Transformation"
Catalyst- for Human Development, January 2008

Brief Research Profile:

My lab combines biophysical, molecular biological and cell biological approaches to address problems of biomedical importance. In addition to basic research into molecular chaperones and heat shock proteins in health and disease we have also produced products and services of value.

A few important contributions are:

1. Development of Photoacoustic Spectroscopy for chemical and biological systems such as petroleum cracking catalysts, solid state photochemistry and mode of action of quinoline class of anti-malarial drugs.

2. *In situ* spectroscopy of intact eye lens: Cataract and UV light connection

3. Smoke and cataract connection: compromised Na^+/K^+ pump.

4. Development of "Red Edge Excitation Shift (REES)" for intact biological systems such as eye lens and membranes. This approach is subsequently extensively used.

5. Demonstration of Chaperone-like activity of alpha-crystallin against photo-aggregation of gamma-crystallin.

6. Demonstration of structural perturbation leading to enhanced activity of alpha-crystallin, which was shown to be a general phenomenon with other small heat shock proteins since they need to function at non-permissible temperatures.

7. Genetic Engineering of chimeric alpha-crystallins with significantly higher activity; one chimeric protein patented for potential therapeutic use.

8. Demonstration of high affinity copper binding of small heat shock proteins; role in redox silencing and pathology.

Translational / Application Oriented work:

1. Developed a multi-parametric PAS approach to discriminate tea samples for Hindustan Lever. (during 1990s)

2. Developed a method for large scale production of an industrially important peptide as a fusion protein using one of heat shock proteins, for Celestial Biolabs Ltd. (2004-5)

3. Development of DNA based diagnostic chip for ophthalmic infections; commercialised by Xcyton Diagnostics Ltd. This product is recognised as the "Product of the Year" (2008) and received "Asia Pacific Biotechnology Award" for the product of unmet need in the Asia Pacific Region (2009).

4. Development of DNA based diagnostic chip for septicaemia and antibiotic resistance. Completed the product development with Xcyton Diagnostics Ltd.

Current Translational research projects on hand:

5. Development of a new, more efficient, compound for photodynamic therapy. We have patented one molecule; an improved version is being patented. Pre-clinical studies are in progress. Effectively treated xenograft with no observable histopathalogical changes in other vital organs. This PDT molecule can also be developed for treating AMD (currently available PDT cost about Rs 75,000 per vial)

6. Development of a very effective drug candidate for retinoblastoma. Cell culture and in vivo studies carried out so far gave excellent results with complete resolution of xenograft. Recently imported an animal model for Retinoblastoma for final studies before initiating clinical studies.

7. Developing a smart nanoparticle system for drug delivery to anterior segment of the eye. This gelatin-based nanoparticle system anchors to cornea to increase residency time, inhibits inflammation and releases anti fungal agent depending on the severity of the infection. All animal studies have proven to be safe and effective in resolving fungal keratitis.

8. Developing an affordable, low tech pregnancy detection kit for cattle (with younger colleagues)

Brief description of research activity:

Our *in situ* investigations on malarial parasites using photo acoustic spectroscopy provided first experimental evidence for the presence of hemin aggregates along with the pigment and lead to a model for possible mechanism of action of quinoline class of drugs (***Science, 1984***).

Our intact lens fluorescence spectroscopic studies, including synchronous scan and Red Edge Excitation Shift, have provided significant insight into the mobility and molecular packing of eye lens proteins which are relevant in lens transparency and cataract (***Photochem. Photobiol., 1987, 89, 90; BBRC., 1991***). This was the first application of REES to intact biological sample. We have also investigated photochemical damage to the eye lens highlighting the importance of sunlight in cataractogenesis. We have investigated the smoking and cataract connection and showed that Na^+/K^+ pump activity is compromised in lenses exposed to smoke condensate (***Cur. Eye Res., 1995***).

We have shown that temperature dependent structural perturbation leads to enhanced activity of a small heat shock protein, α-crystallin (***J.Biol.Chem.*, 1994**). This appears to be a general phenomenon with small heat shock proteins. Our studies suggested that the loss of chaperone activity is the molecular basis for desmin related myopathy associated with R120G and cataracts associated with R116C mutations in alpha crystallin (***J. Biol. Chem.*, 1999**). Our biophysical and molecular biological investigations of

α-crystallin have shown structure-function relationship and possibility of increasing the activity by structural alterations (***series of publications in J. Biol. Chem. and a few others FEBS Letters, Biochem. J etc***). This finding opened up the possibility of mitigating the complications arising out of protein misfolding and aggregation by enhancing chaperone-like activity.

Utilizing molecular biology tools we have engineered chimeric proteins with several fold higher activity with potential therapeutic applications (***J. Biol. Chem*.., 2000, 2002, 2003**). We could also demonstrate that a biocompatible, small molecule can enhance the chaperone activity. Interestingly, this molecule can also help mutant protein (R120G, that leads to desmin related myopathy) to gain almost about 80% of the activity. Our later, cell biological, studies showed the possibility of α-crystallin's role in stabilizing the nuclear matrix (***Exp. Cell Res*., 2004**), transcriptional apparatus and cytoskeletal organization (***J. Mol. Biol.,* 2007**). Recently a cataract-causing mutation (G98R) is reported from India. Our study showed that the mutation leads to folding defective, aggregation prone protein. Despite such deleterious protein the cataract is pre-senile and not congenital; our studies have shown that the mixed oligomer formation might be responsible for the absence of congenital cataract (***Mol. Vision*, 2006. *J. Mol. Biol.,* 2007**). Presence of copper enhances the deleterious effects of the mutation; an example for environmental modulation of phenotypic outcome of a genotype.

The small heat shock proteins are critical in several cellular processes. These proteins are known to work in concert. Human genome has 10 small heat shock genes. My lab is working on HspB1, HspB2, HspB3, HspB4, HspB5 and HspB8. We have shown that HspB8, earlier known as hsp22, has a putative heat shock factor-1 binding region (upstream of coding region) and demonstrated that indeed HspB8 can be over expressed at heat shock temperatures (***Biochem. J.,* 2004, 2007**). Hsp33 is an interesting heat shock protein under redox control. Hsp33 *in vivo* exists as a reduced molecule with no activity. Upon oxidative stress, it becomes active and prevents aggregation of proteins. We have shown that oxidative activation of hsp33 involves conformational change accompanying significant increase in the surface hydrophobicity. This provided the molecular basis for the oxidative activation. The two reported crystal structures of Hsp33 lack about 60 amino

acids at the C-terminus. We have carried out small angle X-ray scattering studies of the full-length protein and determined the *ab initio* shape profile. Based on these, we could suggest that the C terminal region can fold over and prevent inter-protein interaction. Oxidation leads to opening of this region and formation of active dimers (***J. Biol. Chem*.., 2004**)

In addition to working with the protective small heat shock proteins, we also work with the aggregation prone proteins such as Prion, α-synuclein and β_2-microglobulin. Our studies have provided mechanistic insights and also the role of small heat shock proteins in preventing the fibril formation of these proteins (***Biochemistry,* 2005, *Biochem. J* 2005, *J. Mol. Biol.,* 2006, 2007, 2008)**. Our recent study showed the UV-exposed Prion protein loses its ability to form fibrils: interestingly, however, retains its fibril extension ability if seeded by pre-formed fibrils, separating the fibril initiation and extension events (***PLoS ONE*, 2008**). Our recent studies demonstrated that small heat shock proteins bind copper with a very high affinity (picomolar) and confer cytoprotection against oxidative damage. This is a novel property of small heat shock proteins. It has added a new dimension to the functioning of small heat shock proteins. We have demonstrated that αB-crystallin, a small heat shock protein, modulates NF-kappaB activity and protects cells from TNFα-induced cytotoxicity. Our studies have demonstrated that αB-crystallin plays a role in muscle differentiation via ubiquitin-proteosome-mediated degradation of MyoD.

Applied Research:

DNA Based Diagnostic Chip for Ophthalmic infections:

In a multi-institutional project, we have developed a platform technology for DNA-based identification of pathogens causing eye infections. This technology is based on multiplex PCR for identification of DNA sequences for several pathogens in a single tube reaction by designing appropriate primers against specific target sequences to minimize non-specific hybridization. This methodology is very sensitive and highly specific, enabling the rapid identification (in about 5 hours) of up to 15 pathogens in a single multiplex

reaction. The chip format and visual detection of end result makes this technology adaptable to district level hospitals with semi-skilled personnel. This product is now commercially launched and adjudged as the “product of the year (2008)” by the “Biospectrum”, biotech business magazine from India. This product was also awarded “Asia Pacific Biotechnology Award” at Bio-Singapore 2009 as a biotechnological product for major unmet need.

DNA Based Diagnostic Chip for septicaemia and antibiotic resistance:

The same platform technology is developed for detection of pathogens causing septicaemia and encephalitis, and for the evaluation of antibiotic resistance. These chips are in advanced stages of commercialization.

Photodynamic Therapy:

We, in collaboration with National Institute for Interdisciplinary Science, Trivandrum have developed a novel water-soluble molecule which showed higher *in vitro* photodynamic activity, compared to the U.S. Food and Drug Administration approved and currently being used photosensitizer, in different cell lines under identical conditions. This molecule showed rapid cellular uptake and localized in the nucleus of the cells, thereby demonstrating its use as an efficient sensitizer in photodynamic therapy. We are carrying out detailed pre-clinical studies and also working with an improved molecule.

Retinopathy of Prematurity (ROP): ROP is a serious complication in the retina of premature babies with low birth weight. A significant proportion of premature babies who are treated with higher levels of oxygen in incubators develop retinopathy of prematurity. The molecular mechanism and the prognosis are not understood. We have initiated a project to investigate genomic and proteomic alterations in the premature babies in comparison with normal babies and also to see if any correlation can be arrived at for predicting the development of ROP. For this, we have developed a methodology for doing total proteomics of vitreous humor collected from premature babies. We have achieved total proteome from a single sample – without pooling. Gene ontology and

pathway analysis resulted in interesting finding including role of complement pathway in the process. The study is likely to result in a biomarker in addition to identifying targets in the complement pathway and coagulation cascade. If successful, this will make a significant difference in preventing blindness in premature babies.

Retinoblastoma: Retinoblastoma, ocular cancer, is mostly associated with early childhood. Serendipitously, we observed that a small molecule disrupts clusters of retinoblastoma cell line – Y79. The Y79 cells grow in clusters: disruption of clusters leads to cell death. By doing proteomics, we identified that a large number of cell adhesive molecules are involved in the process. Interestingly, we also observed that oncogene products are down regulated and several anti-proliferative factors are up regulated upon treatment with this small molecule.

Cell culture studies showed that this molecule is effective in killing cancer cells. We then moved to *in vivo* models. Xenografted nude mice (with of Y79 cells) developed tumors. Treatment of these tumours with our small molecule resulted in dramatic regression of the tumors. We have carried out histopathological evaluation of liver, spleen, lung, kidney, and heart and found that none of these tissues is affected upon treatment with the small molecule. This appears to be an excellent, non-toxic, water-soluble small molecule for retinoblastoma. We are in the process of completing pre-clinical studies and subsequently clinical studies.

Smart Nanoparticle based drug delivery system:

Microbial keratitis is a major ophthalmologic problem in tropical countries like India. It is characterized by corneal ulceration, stromal abscess formation, corneal edema, and anterior segment inflammation. About 30% cases in our country lead to blindness. A treatment for microbial keratitis requires meeting several challenges including rapidly reducing the number of pathogens and simultaneously controlling the corneal damage.

Controlled drug delivery to the eye is one of the most challenging fields of pharmaceutical research due to the low drug contact time and the pre-corneal loss of conventional eye drops. Nanoparticle-based ocular drug delivery, with an increased

retention time on the corneal surface and a sustained release of the encapsulated drug, is a promising approach to treat external and intraocular eye infections. The fungi reach the cornea, attach to it and then release enzymes to breakdown the cornea and use its components as nutrients. The host also responds by its defense mechanisms. Both these result in corneal damage, which can lead to scar formation compromising the vision. Our lab has identified specific enzymes released by the pathogen as well as the host. We have developed smart polymer-based biocompatible nanoparticles carrying a drug. These nanoparticles contain several condition-responsive, smart features. Anti-TLR4 conjugation increases the corneal residence time of the nanoparticles and suppresses the infiltration of neutrophils and vascularization in the corneal epithelium. Corneal binding and anti-inflammatory activity are dependent on the severity of infection. Drug release depends on the protease concentration in the microenvironment. Our polymer-based nanoparticle acts as an alternative substrate for the proteases. By combining the specific formulation with the smart delivery mechanisms, we have successfully treated the infection in animal model systems. Clinical trials will be undertaken subsequently.

I strongly believe that my multidisciplinary awareness including electronics, fabrication and digital interfacing along with cellular, molecular and biophysical approaches enabled me to provide vision and leadership in several in-house (CCMB) and external projects.

List of Publications

Bhaswati Chatterjee, Alexander Makarov, David E. Clemmer, Hanno Steen, Judith Steen, Wendy Saffell-Clemmer, AbhayR. Moghekar, Ch. Mohan Rao, Ralph A. Bradshaw, and Suman S. Thakur: Proteomics in India: A report on a Brainstorming meeting in Hyderabad, India
Molecular & Cellular Proteomics (in press)

Raman Bakthisaran, Kranthi Kiran Akula, Ramakrishna Tangirala, and Ch. Mohan Rao: Phosphorylation of αB-crystallin: Role in stress, aging and patho-physiological conditions
Biochimica et Biophysica Acta (General Subjects) **1860,** 167-182, 2016

Taraprasad Das, Srinivas Volety, Saad Ahsan, Abhay Thakur, Savitri Sharma, Soumyava Basu, Tapas Padhi and Ch. Mohan Rao: Safety, sterility and stability of direct- from- vial multiple dosing intravitreal injection of bevacizumab
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Raman Bakthisaran, Ramakrishna Tangirala and Ch. Mohan Rao: Small heat shock proteins: role in cellular functions and pathology - "most downloaded paper"
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Current Stem Cell Research Therapy, **9(6)** 458-68, 2014

Issac J Micheal, Aditya J Vidyasagar, Kiran Kumar Bokara, Naveen Kumar Mekala, Amit Asthana and Ch. Mohan Rao: Foil assisted replica molding for fabrication of microfluidic devices and their application *in vitro*
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Prabhu S, Raman B, Ramakrishna T and Ch. Mohan Rao: HspB2/Myotonic Dystrophy Protein Kinase Binding Protein (MKBP) as a Novel Molecular Chaperone: Structural and Functional Aspects
PLoS ONE , **7 (1)** , 1-10, 2012

Pradeep Mishra, C. Ratna Prabha, ,Ch. Mohan Rao, Srinivas Volety : Q2N and S65D Substitutions of Ubiquitin Unravel Functional Significance of the Invariant Residues Gln2 and Ser65
Cell Biochem Biophys, **61(3)**, 619-628, 2011

Abhay Kumar Thakur, Atul Kumar Srivastava, Volety Srinivas, Kandala Venkata Ramana Chary and Chintalagiri Mohan Rao: Copper alters aggregation behavior of prion protein and induces novel interactions between its N- and C-terminal regions
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Patents Granted:

1. **US Patent:** A novel method for simultaneous detection and discrimination of bacterial, fungal parasitic and viral infections of eye and central nervous system

   Inventors: Ch. Mohan Rao, K Sridhar Rao, P V Ramchander, H N Madhavan, Savitri Sharma, Gita Satpathy, B V Ravi Kumar

   Patent No. & Date Granted: 8,465,951 & 18/6/2013
   Also published in **Canada, China, Europe and WO**

   (This patent is commercialized: product in the market)

2. **US Patent:** Chimeric protein a BNAC crystallin with extraordinarily high chaperone-like activity and a method related to the use thereof.

   Inventors: Kumar; L. V. Siva (Hyderabad, In); Ch. Mohan Rao (Hyderabad, In)

   Patent No. & Date Granted: 6958224 & 25/10/2005

3. **US Patent:** Process for the preparation of novel porphyrin derivatives and their use as PDT agents and fluorescence probes

   Inventors: D Ramaiah, Suneesh C Karunakaran, J S Vadakkancheril, Chandrashekar K T, Srinivasan A, Madhavan R P, Sivakumari A N, Saneesh Babu P S, Ch.Mohan Rao, K Sridhar Rao

   Patent No. & Date Granted: 2012/0308485 & 12/6/12

   (This patent has very high potential to compete with an expensive international product: pre-clinical studies done)

4. **US Patent:** Preparation, characterization, ESR and PAS studies of Cu0.5NbAIP3O12 and HNbAIP3O12 (HNP)

   Inventors: Vithal; M. (Andhra Pradesh, In); Srinivasulu; B. (Andhra Pradesh, In); Rao; K. Koteswara (Andhra Pradesh, In); Ch. Mohan Rao (Andhra Pradesh, In)

   Patent No. & Date Granted: 6942843 & 13/09/2005.

Patents filed:

1. Novel Chlorin based compounds, A Process for preparation thereof and use as Photodynamic Therapeutic Agents and Fluorescent Probes

   Inventors: Marydasan Betsy, Bollapalli Madhuri, Danaboyina Ramaiah, Kunchala Sridhar Rao, Chintalagiri Mohan Rao, Tavarekere K. Chandraheka, Suneesh C. Karunakaran

   Appl. No. & date filed : 2993del2015 & 22/9/2015

2. Protein Nanostructures for the delivery of Therapeutic Agents to the anterior segment of the Eye

   Inventors: Saad Mohammad Ahsan, Chintalagiri Mohan Rao

   Appl No. & date filed: 3745del2015 & 17/11/2015

3. Small Heat Shock Protiens as Inclusion Body Tags for Peptide synthesis and purification

   Inventors: Saad Mohammad Ahsan, Abhishek Asthana, Srinivas Volety, Raman Bhaktisaran, Ramakrishna Murti Tangirala, Sridhara Rao Kunchela, Mohan Rao Chintalagiri

   Appl No. & date filed: 201611002196 & 21/01/2016