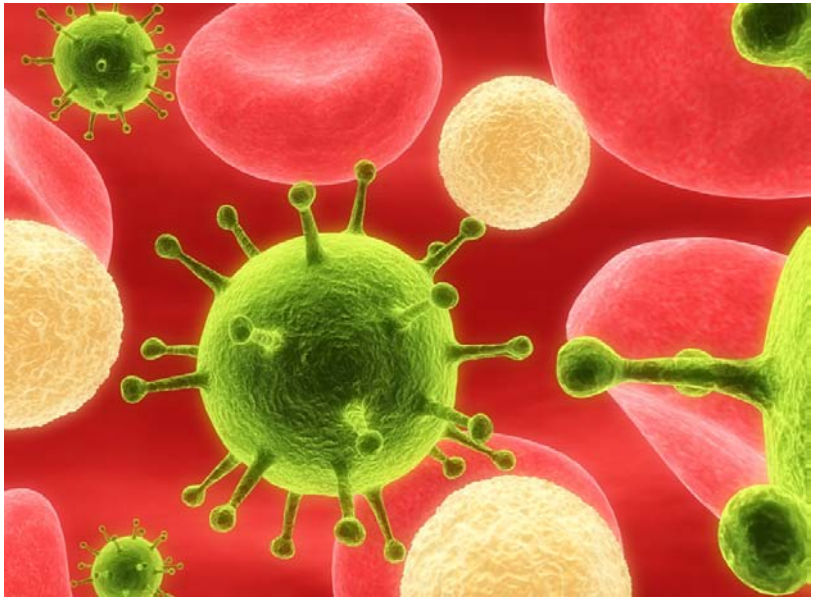
First Pakistan International

BIOPHYSICS SYMPOSIUM

NED University of Engineering and Technology, Karachi, Pakistan



PROCEEDINGS VOL-I
BOOK OF ABSTRACTS

June 1st-2nd, 2012

Held under the aegis of
The Higher Education Commission
(HEC), Pakistan

Department of Biomedical Engineering, NED University of Engineering & Technology,
Stadium Road, Karachi, Pakistan

Symposium Patrons

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Biophysics Symposium, June 1st-2nd,2012

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Poster Contributions (Faculty/ Graduate Student- Scholar Tier)

Poster Contributions (Guided Student- Scholar Tier)

PROGRAM

THE FIRST PAKISTAN NATIONAL BIOPHYSICS SYMPOSIUM
INCLUDING 1ST NATIONAL STUDENT MEETING

NED University of Engineering & Technology,
Karachi
NED Main Campus, Civil Auditorium
June 1st-2nd 2012

June 1st 2012

Inauguration Ceremony
(Venue: NED Auditorium, Main Campus)

0900	Inauguration Ceremony Commencement & Recitation
0910	Welcome Address by the Convener, Dean BME, NEDUET
0920	Inaugural Address by the Chief Guest & Chief Patron, Vice Chancellor, NEDUET
0930	*"Biophysics and its Significance in Modern Life Sciences"*, a Guest Speech by the Guest of Honor, Prof. Paul Anderson, QMUL, London
0950	*"Biophysics : A Case for Pakistan"*, Prof. Masroor H. S. Bukhari, Visiting Foreign Professor, Higher Education Commission of Pakistan at the NED University of Engineering & Technology.
1000	High Tea

Day I Scientific Sessions
(Venue: Video Conf. Hall, Dept. of Civil Engg., NED, Main Campus)

1030 Joint Scientific Session #1:
Joint Scientific Session #1A, #1B& #1C: Dental Biophysics & Biomaterials; Stem Cell Biophysics; and Radiation Biology & Physics

Chair: Prof. Paul Anderson
Co-Chair: Prof. S. K. Hasanain

1030	*Symposium Opening Message from the Chair at Large, Professor Munir H. Nayfeh, Nano Physics Center, University of Illinois at Urbana-Champagne, Illinois, USA,* "Biophysics and the Nano-world – Current Perspective & Future Vista's".

1035 *Keynote Lecture #1: Max Perutz Memorial Plenary Talk:* Prof. Paul Anderson, The Queen Mary, University of London, London, England *"Molecular biophysics –*
An Overviewand a special case study: structure related tofunction of the salivary protein Statherin"

1125 Q&A/Discussion Session

1130 Oral Contribution #1A-1: W. A. A. Syed *et al.*, IIU, Islamabad, "Potential role of Nano-oxides and their Complexed forms with Photosensitizers inPhotodynamic Therapy"

1145 Oral Contribution #1A-2: S. I. Malick *et al.*, NUST, Islamabad, "Radioprotective consequence of Amifostine on cells from cancer prone patients and healthy individuals studied by the G2 and PCC assays"

1200 Oral Contribution #1B-1: S. Siddiqui *et al.*, QMUL, London, "2D Synchrotron X-ray Diffraction Mapping of Dental Enamel Affected by Caries"

1215 Q&A/Discussion Session

1220 *Invited Talk: McCullogh-Till Lecture:* Prof. Tashmeem Razzaki, SIUT, Karachi, "Stem Cell Biology & Biophysics: Past,Present & Future"

1250 Q&A/Discussion Session

1300 Break for Friday Prayers/Luncheon I
1400 Luncheon II

1430 Scientific Session #2
Joint Scientific Session #2A& #2B: Biotechnology & Tissue Engineering;
& Biomimetics & Biomechanics

Chair: Prof. Atiya Abbasi
Co-Chair: Prof. Ali Raza Jafri

1430 *Invited Talk:* Prof. Umar Dahot, IBGE, SUJ, Jamshoro, "Production, Purification And Characterization of Xylanase by Pleurotuseryngii and Effects of Various Parameters Such as Temperature"

1500 Q&A/Discussion Session

1515 Oral Contribution #2A-1: Baila Samreen *et al.,* SIUT, Karachi, "Modulation by Cisplatin and Oxyplatin of mRNA Expression of a Selected Set of Genes in Colorectal Cancer Cell Lines"

1530 Oral Contribution #2A-2: M. Rafiq *et al.,* IBGE, SUJ, Jamshoro, "Azadirachtin-Related limonoids production through cell suspension culture of Neem"

1545 Sana Khawer-Mohsin, BME, NEDUET, Karachi, "Possibilities of Mutations in Growth Hormone Genes in Goat (*Capra hircus*)"
1600 Oral Contribution #2B-1: I. C. Gebeshuber *et al.*, TUW Vienna/UKM, Kuala Lumpur, "A new generation of MEMS in medicine to assist, enhance and expand human sensory perceptions"
1615 Q&A/Discussion Session
1600 *Invited Talk: Zafar H. Zaidi Lecture*: Prof. Atiya Abbasi, HEJRI, UOK, Karachi, "Plant Proteins- Structural and Functional Implications in Health and Disease"
1630 Q&A/Discussion Session

1645 Scientific Session #3 : Poster Presentations (including Competition Judgment)

1645 High Tea & Poster Gallery Visit by the Jury & Guests
1745 Day 1 Closing

Judges Panel:
Prof. Paul Anderson
Prof. Ille C. Gebeshuber
Prof. Z. H. Shah

June 2nd 2012

Day II Scientific Sessions
(Venue: Video Conf. Hall, Dept. of Civil Engg., NED, Main Campus)

0900 Scientific Sessions #4A &4B:
Joint Scientific Session #4A, #4B& 4C: Cellular Biophysics & Complex Systems; *Computational Biology & Biophysics; and Detector Design & Techniques in Biophysics*

Chair: Prof. Ille C. Gebeshuber
Co-Chair: Dr. Masroor H. S. Bukhari

0900 Day Opening with Recitation

0905 Keynote Address #2: Prof. Omar Bagasra, Claflin Biotechnology Center, Claflin University, South Carolina, USA
Francis C. Crick Memorial Plenary Talk: "MolecularBiology & Biophysics in the Era of the Nanoworld"
0935 Q&A/Discussion Session
0940 *J. D. Watson Lecture: Prof. Shahid Khan, MBC, LBNL, Berkeley & LUMS, Lahore, "Advanced Problems in Contemporary Molecular Biophysics and The Molecular Biophysics Consortium at The Lawrence Berkley National Laboratory"*
1010 Q&A/Discussion Session
1020 *Invited Talk:* Ms. Saman Hussain, HarvardU, Cambridge, "Emergence of long range order in active actin gels"
1050 Q&A/Discussion Session
1100 *Invited Talk: Max Delbruck Lecture:* Dr. Masroor H. S. Bukhari, HEC at NEDUET, Karachi,and UM, Kuala Lumpur, "Life in the Mesoscopic Regime: An Exciting and Non-Quiescent Physical World With Great Potential for Future Biology"
1130 Q&A/Discussion Session
1145 Hi-Tea

1215 Scientific Session #5:
Session #5: Biosensors & Bioelectronics

Chair: Prof. Tashmeem Razzaki
Co-Chair: Prof. S. Tajjamul Hussain

1215 *Invited Talk: Walther H. Nernst Lecture:* Prof. S. Tajjamul Hussain, NCP, QAU, Islamabad, "Y-doped titania-CNTs composite as an electrochemical biosensor for Lysine detection"
1245 Q&A/Discussion Session
1255 *Invited Talk:* Prof. S. Khurshid Hasanain, DOP, QAU, Islamabad, "Nanophysics and its Biomedical Applications: The Potential and the Challenges"
1325 Q&A/Discussion Session

1330 One-hour Break for Prayers and Lunch

Scientific Sessions #4&#5:
Bioelectromagnetism; and Clinical Biophysics
Chair: Prof. Zahoor H. Shah

Co-Chair: Prof. Umar Dahot

1430	Keynote Address #3: Prof. Ille C. Gebeshuber, Technical University Vienna, Vienna, Austria, and National University Malaysia (UKM), Kuala Lumpur, Malaysia, *Wilhelm C. Roentgen Memorial Plenary Talk: "Biophysics in an age of convergence: Challenges and prospects"*
1515	Q&A/Discussion Session
1525	*Invited Talk: Hodgkin-Huxley Lecture:* Prof. Hamid Mobasheri, IBB, UT, Tehran, "Effects of electromagnetic field on living systems, a biophysical approach at single molecule level in real time"
1555	Q&A/Discussion Session
1605	Special Student Oral Contribution: Mr. Syed Ali Mesam Kazmi, NEDUET, and Dr. M. H. S.Bukhari, "Computational biophysics in medicine – A synergistic bridge between basic biology and clinical medicine"
1620	Q&A/Discussion Session
1630	Hi-Tea
1630	**Scientific Sessions Closed**

1645 Closing Ceremony

1645	Closing Ceremony Commencement with Recitation
1655	Symposium Overview& Vote of Thanks by the Principal Organizer & Symposium Secretary, Dr. M. H. S. Bukhari, HEC at NEDUET
1715	*"The era of the Nano-World and Opportunities for Pakistan",* Guest Speech by Guest of Honor, Prof. Ille C. Gebeshuber, TUW, Austria& UKM, Malaysia
1740	Presidential Address by the Chief Guest, Vice-Chancellor, NEDUET
1750	Honors & Awards Distribution Ceremony by the Chief Guest
1800	**Symposium Formally Closed**

June 3rd 2012

Excursions for Guests (Optional)

KEYNOTE & INVITED LECTURE SPEAKERS' BIOGRAPHIES

Symposium Chair at Large

Distinguished Professor
Munir H. Nayfeh
Nanoscience Physics Group,
University of Illionis at Urbana-Champagne,
Urbana-Champagne, Illinois, USA

PhD (Stanford)

An Eminent Theoretical Physicist and
Experimental Biophysicist with Momentous Contributions
To the Fields of Photonics and Nanoelectronics

Professor Munir Nayfeh's name does not need any introduction, as he is one of the world's eminent scientists in Theoretical Physics, Nanoscale Physics and Photonics.

He received his Bachelor's and Master's degrees from the American University of Beirut in 1968, and 1970, respectively. He earned a Ph.D. in Nuclear Physics from Stanford University in 1974. He served as a postdoctoral fellow and research physicist at Oak Ridge National Laboratory from 1974-1977, and as a lecturer at Yale University in 1977, before joining the physics faculty at the University of Illinois in 1978.

Following his arrival at the UIUC, Professor Nayfeh developed an active experimental program to study the multi-photon (nonlinear) dissociation of molecules as a means to enhance dissociation selectivity. He was the first to demonstrate isotope separation using this process. He was also the first physicist to examine the behavior of hydrogen molecules in intense laser fields, and his seminal work in this area initiated a whole new area of research in molecular Coulomb explosions.

In the past few years, Professor Nayfeh has pursued two separate lines of research: (1) a theoretical program focusing on the role of classical chaotic dynamics in hydrogen atoms rendered essentially one-dimensional in the presence of very strong dc electrical fields; and (2) an experimental program he has termed "writing with atoms," in which the spatial selectivity of the electric field in a scanning tunneling microscope (STM) is combined with the frequency (energy) selectivity of a laser to deposit fine patterns with nearly atomic resolution on a variety of substrates at room temperature. Dr. Nayfeh was solely responsible for the conception and development of this innovative technique.

Most recently, Professor Nayfeh has investigated the fabrication and the analysis of nanometer-scale structures by employing STM to study hysteresis effects in the formation of matter. This work provides physical insights on the fundamental nature and interactions of solids at nanometer/atomic scales, and it has significant implications for near-term technological applications in nanoelectronics and photonics.

Professor, Institute of Applied Physics, Technical University Wien, Vienna, Austria,
and Professor,
Institute of Microengineering and Nanoelectronics (IMEN),
The National University Malaysia (Universiti Kebangsaan Malaysia, UKM),
Bangi, Malaysia

Dipl.-Ing. (Vienna), PhD (Vienna), *Hab. V. l.* (Vienna)

A World Leader in Biomimetics and Tribology,
Acclaimed Scientist in Interdisciplinary Sciences and Renowned Science Speaker

Prof. Ille C. Gebeshuber is a University Professor of Physics from Austria, Europe. She is expert in Nanotechnology, Biomimetics and Tribology. She was born on April 10, 1969, in the small city Kindberg in Austria, Europe. On the schoolbus, when she wrote a message on the window to a friend who was outside, she discovered that - a natural lefthander - she can write in mirror. She uses this ability to stimulate the right side of her brain and thereby her creativity and cross-border thinking. This has had major influence on her scholarly development and achievements - unlike most other physicists and engineers, her approach to science is wide and holistic, and inherently trans- and interdisciplinary, bridging over to biology, the arts and the social sciences.

Since 2009 she has been at the Institute of Microengineering and Nanoelectronics at University Kebangsaan Malaysia. Her permanent position is at the Institute of Applied Physics at the Vienna University of Technology. Prof. Ille is associate editor of the IMechE Journal of Mechanical Engineering Science (SAGE Publishing, London, UK), editorial board member of various scientific journals, and author of two books on biomimetics and nanotechnology and editor of a book on biomimetics by Springer Scientific Publishing. Since 2011 she has been scientific advisory board member regarding nanotechnology for the Lifeboat Foundation, a US American think tank safeguarding humanity. Her research interests comprise the use of nanotechnology and biomimetics to address global challenges for humankind.
Prof. Gebeshuber has received a number of high honors and awards throughout her career, and serves on various international strategy boards. She has received “The Top Ten Women in Science & Research Ranking“ (Woman, 2008), The SUCCESS prize (European Space Agency, 1999), The Wiener Wirtschaft Technology Prize (Vienna University of Technology, 1999), Expert of the Month (FEMtech, 2008), The Innovative Project Initiative (Vienna University of Technology, 2005), Winner of the Research Project Initiative (Hochschuljubiläumsstiftung der Stadt Wien, 1999), in addition to a number of first prizes at student competitions and one photography competition.

She has been acting as reviewer and advisor for agencies, universities, research institutions and public bodies. Prof. Ille is doing extensive public science outreach work and her professional activities are widely covered in the media. She loves to go on rainforest expeditions with her students, who come from different cultures and different fields (Europe & Asia, physics, engineering, biology, veterinary medicine, applied arts, fine arts). Her research interests are located at the interface of biology, engineering and the arts, systems thinking and nanotechnology. The media extensively cover her research and professional activities. She is advisor in various expert panels, including the Science Advisory Board (Arlington, USA), the Strategy Board of the Austrian Center of Competence for Tribology (Wiener Neustadt, Austria), QS University Rankings and the ISESCO Expert Panel on Nanotechnology.

Prof. Paul Anderson

Queen Mary University of London (QMUL),
London, UK
(Member of the Institute of Physics, UK, and Chartered Physicist, IOP, UK)

BSc (Leeds), PhD (London), MInstP (UK), CPhys (UK)

One of the Pioneers and World Leaders in Dental Biophysics and Biomaterials

Professor Anderson did his BSc in Biophysics from Leeds in 1982 and PhD in Biophysics from University of London in 1988, his advisor a well-known scientist, Prof. J. C. Elliot, being a student of the pioneering biophysicist and Nobel laureate, Prof. Max F. Perutz. He was elected as a Member of the Institute of Physics in 1990.

He is a member of a number of distinguished bodies, such as British Society for Dental Research, International Association of Dental Research (IADR), European Organisation for Caries Research (ORCA), British Biophysics Society, and Association of Basic Science Teachers in Dentistry (Committee member).

He has advised five post-doctoral fellow and a number of PhD, MSc and BSc project students. He has 83 publications in some of the world's leading peer-reviewed journals of repute, in addition to countless proceeding reports in reputed international scientific meetings.

His main research area is the chemistry of enamel and hydroxyapatite in the context of de- and re-mineralization of enamel. Recently, he has developed research into the influence of salivary proteins on these processes, to study their role in enamel homeostasis. He has also developed novel X-ray absorption microscopies to assist with these studies, and have also used these technologies to study diffusion processes in enamel, and the efficacy of treatments for dental hypersensitivity. He has been sponsored by the MRC, EPSRC, Wellcome, as well as RAB, and QMUL grants. Professor Anderson has several PhD students and is running currently the only program of the world in Dental Biophysics & Biomaterials.

Prof. Dr. Omar Bagasra

Professor and Director,
South Carolina Center for Biotechnology,
Claflin University,
Orangeville, South Carolina, USA

BSc, MSc (KU), MD (USA), PhD (USA)

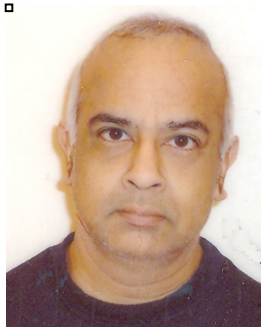
A Leading Biotechnologist, Immunologist, Geneticist and Virologist

Prof. Omar Bagasra is a Tenured Professor of Biotechnology and Director of the South Carolina Center for Biotechnology at Claflin University. Dr. Bagasra's research interests have long been associated with the study of HIV and AIDS. In fact, he has been on the trail of the virus since 1981—the year of the first scientific report. For the past several years, he has focused on trying to gain insight into the molecular pathogenesis of HIV and role of microRNA in protection against lentiviruses. In 1998, he was the first to clearly discuss the protective role of small RNAs against retrovirus and lentivirus ("HIV and Molecular Immunity,"). His unswerving dedication to his work has resulted in over 200 scientific articles, book chapters, and books. In 1995, he was nominated for the King Faisal Award for Medicine. During the last few years he has received several national and international prestigious awards and recognitions. In 2002 he received Faculty Scholar Award from the American Association for Cancer Research. In 2006 he was the co-recipient of the South Carolina Governor's Award for Excellence in Science Awareness. From 2002-2006 he also served as the Council Member of the American Association of Cancer Research (MICR-AACR).

*The Institut Pasteur's*Luc Montagnier – the discoverer of the AIDS virus and 2008 Nobel Laureatedescribed Dr. Bagasra as "a skilful researcher…(and) a discerning scholar who explores new ideas", observing he already had a track record for challenging conventional wisdom and being proved correct. "Every scientist now knows that a significant percentage of circulating lymphocytes are infected with HIV….but in 1992 Dr Bagasra's findings were highly controversial,"

Currently, Dr. Bagasra is funded by several federal agencies and is working on a novel vaccine against HIV and on an early diagnosis of prostate cancer. He is also involved in Biofuel and Biodefence projects and in setting up the DNA Service Forensic laboratory for Claflin University. His undergraduate and graduate students have received top awards at the national and international levels and have published in peer-review journals. Many of his recent research have brought national attention to Claflin University.

Prof. Shahid M. Khan



Senior Scientist,
Molecular Biology Consortium,
U.S. Lawrence Berkeley National Laboratory,
Berkeley, CA, USA
Professor of Biophysics, LUMS, Lahore, Pakistan
Visiting Professor
Harvard University, Cambridge,
Massachussets, USA

PhD (Yale), Post-Doc (Caltech)

One of World-leading Biophysicists in Cellular Biophysics &
The Senior-Most Pioneering Biophysicist in the Nation

Prof. Dr. Shahid Masihuddin Khan is one of the world's senior Cell Biophysicists. He is currently based at the Lawrence Berkeley National Laboratory, Berkeley CA as Senior Scientist with the Molecular Biology Consortium. He was part of the core group that established the LUMS School of Science & Engineering in Lahore (Pakistan) and was the founding Head of the life sciences group that has since evolved into autonomous Biology and Chemistry departments. Dr Khan did his Ph.D. in Molecular Biophysics from Yale University and postdoctoral work at CalTech in USA. He obtained his BSc (Hons) from Kings College, University of London, England.

A major part of his career was spent at the Albert Einstein College of Medicine (Bronx, NY) where he rose to be full Professor of Physiology & Biophysics. He has been an established NIH investigator for over two decades. He has over 40 publications and several reviews / book chapters in leading international journals. He has served on several NIH and NSF study sections. He is a member of the MBL Corporation (Woods Hole MA), a senior associate of the Abdus Salam International Centre for Theoretical Physics (Trieste, Italy) and advisor to the Pakistan Higher Education Commission Committee on Biotechnology.

His current research utilizes single molecule and cell imaging and computational methods for elucidation of actin cytoskeletal dynamics in neuronal dendritic spines and the supramolecular architecture of the bacterial flagellar basal body Type III protein export apparatus; a paradigm for homologous systems involved in bacterial pathogenesis.

Professor Hamid Mobasheri

Associate Professor of Biophysics, IBB, University of Tehran, Iran,
Head of Laboratory of Membrane Biophysics and Macromolecules,
Institute of Biochemistry and Biophysics (IBB), and the
Head of Biomaterial Research Center (BRC), University of Tehran

MSc (UEA), PhD (UEA)

Pioneering Biophysicist in Single Membrane Bio-Molecule Analysis in Iran

Professor Mobasheri did his BSc at the University of Tehran (in Cell and Molecular Biology), 1988, and then collaborated on several research projects on nerve and bone growth factors before he was awarded a scholarship to pursue his studies in biophysics overseas. Working on biophysics of single ion channels at the University of East Anglia (UEA), UK, he was awarded an MSc in Molecular Biology and Biophysics in 1995. He then continued his studies on OmpF, OmpC and Mycobacterium tuberculosis nano-channels at single molecular level and received his PhD in Biophysics in 1998 from UEA. Being interested in the biophysics of nano-channel forming proteins, he pursued his researches as Post-Doctoral Fellow at the UEA from 1998-2000. He then moved to University of Tehran and established Laboratory of Membrane Biophysics at the Institute of Biochemistry and Biophysics, where for the first time the biophysical study of the activity of single ion channels in real time took place in Iran.

Since then, he has trained several MSc and PhD students in Biophysics, Biotechnology, Biochemistry, Nanotechnology, Physics, Mechanics, Physiology, Immunology and Medical Engineering, mainly focusing on the molecular biophysics of membrane and its constituents, both experimentally and theoretically.

He believes in following the physical approach to understand biological phenomena and processes at molecular and even at sub-molecular levels and endeavors to unravel various physical, instead of chemical approaches, to address the nature, structure and mechanisms involved with living cell membranes. He attempts to unravel physical bases for reaching possible treatments in cases of abnormalities, disabilities and diseases occurring in human body. Thus, the characteristics of electric and electromagnetic fields created by biological molecules, as well as the effects of ambient fields in the medium or environment, matters a great deal in understanding and manipulation of living systems.

The main focal point of his completed and current projects are in biophysical effects of high-frequency electromagnetic fields on the biological organisms at single molecular level; Biophysics of magnetic and electric field effects on neural cell cultures; Biophysics of ion and antibiotics translocation through OmpC and OmpF porin nano-channels; Bioreactor design and tissue engineering, biophysical monitoring and manipulation of cells seeded in polymeric scaffolds; Surface plasmon resonance and its application in detection and characterization of biological macromolecules; Biophysical investigation of voltage-dependent gating in OmpF nano-channels as a biotransistor, at single molecule levels.

Following the discovery of a new nano-channel forming protein in Mycobacterium tuberculosis, clarification of OmpF nano-channel gating mechanism, and findings on the partial mechanism by which Colicin E9 enters into targeted bacteria, he was recognized as one of the distinguished scientists of year 2005 by Marquis Who's Who (USA) and later on as one of distinguished scientists of year 2006 by IBC (UK) and also as distinguished postgraduate by the Ministry of Science Education, and innovation of Iran 1999.

He is also the recipient of Welcome Trust Post Doctorate Scholarship, 1999, and Research Grant awarded by TWAS, Italy, 2002. He has been a member of different scientific societies including British Biophysical Society (2003-Now), American Biophysical Society (1995 – Now), Australian Biophysical Society (2003-2007), Nanotechnology Society of Iran (2004-now), Iranian Biological Society (2002-now).

Part of his research findings have been published in different Journals including: Nature (Structural Biology), J. Mol Biol. (the article was featured on Journal cover), European J. of Biophysics, J. of Biological Chemistry, Biochemical and Biophysical Research Communication, FEMS, FEBS, Journal of Magnetic Resonance Imaging, etc.

Prof. Zahoor Hussain Shah

MSc (Sind), PhD (Uppsala), Post-Doc (Uppsala)
Former Professor, University of Sindh, Jamshoro, Pakistan

MSc (Sind), PhD (Uppsala), Post-Doc (Uppsala)

A Senior Analytical Chemist, Physical Chemist and One of Pioneering Biophysicists of Pakistan

Prof. Dr. Zahoor Hussain Shah is a former professor of Physical and Analytical chemistry, with a world-class research and teaching career, spanning over thirty-five years in many reputed universities.

He is one of those gifted personalities who served their nation with meritorious services, touching the lives of hundreds of people directly and thousands in turn.

He has on his credit, initiation of many important studies, programs and projects in last thirty-five years. The greatest feather in his cap in recent times is his initiation of Pakistan's first graduate program in the important field of Biophysics, as the chair of the program. While benefiting the program with his great acumen and leadership, as well as using his rich experience in postgraduate education, he laid down the basic framework, curriculum and rules for the program, serving as the Chair of the Graduate Affairs and Policies Committee of the program. In addition, he has taught a number of involved subjects in the program. His momentous role in teaching and planning helped lay down the resolute foundations for this emerging important field in Pakistan.
After doing MSc in Physical Chemistry from the University of Sindh, he proceeded to do PhD in Analytical Chemistry under a joint program of Sind University and one of the world's top universities, the Uppsala University (Sweden). On completion of doctorate he proceeded to do post-doc from Uppsala with a famous scientist, Prof. Wolfgang, and returned to Pakistan to serve his homeland. He worked on some major scientific projects such as determination of fluorine and innovation of new techniques in biophysical and analytical chemistry. He has published a number of important studies to date, since 1973, in reputed journals as well as international conferences.

He is perhaps the only scientist and educationist in Pakistan who has mastered various disparate and important fields of chemistry, ranging from photochemistry to biophysics. He continues to inspire hundreds of students and is a shining beacon house of knowledge and enlightenment for teachers and students alike.

Professor Atiya Abbasi

Professor, HEJ Research Instt. Of Chemistry,
University of Karachi, Karachi, Pakistan
Visiting Professor, University of Lincoln Nebraska, USA,
Former Humboldt Visiting Professor

PhD (KU), Post-Doc (MPI), Post-Doc (Nebraska)

Eminent & Senior Protein Chemist in the Nation

Prof Abbasi did her MSc and PhD from University of Karachi, followed by Post-Doctorals in Germany (Max Planck Institute, Munich) and Nebraska (USA).

She was recipient of the Women Scientist of the Year Award (1999) and Pakistan Academy of Sciences (PAS) Gold Medalist in Biochemistry (2002).
She has authored two books, Protein Structure Function Relationship, Proceedings of the 7th InternationalSymposium (eds. A. Abbasi and S. Abid Ali), BCC&T press, University of Karachi, 2003, and Protein Structure - Function, Proceedings of the 5th International Symposium (eds. Z. H. Zaidi, & A. Abbasi,) J. Chem. Soc. Pak. 1999.

In addition to that she has written a number of chapters in books. She has authored around hundred papers in reputed international journals. Her some selected publications are;

Structural basis of protein function: The role of residues in stability and activity -A. Abbasi**,** G. Lutfullah, R. Sattar and S. A. Ali Proceedings of the 7th
International Symposium on Protein Structure Function Relationship (eds. A.Abbasi and S. Abid Ali) BCC&T press, University of Karachi, 2003, p.17.

Molecular basis of thermo-stability: Prediction of the three dimensional structureof subtilisin from a thermostable *Bacillus subtilis* strain RT5, M. Kamal, S. A. Ali and A. Abbasi, Proceedings of the 7th International Symposium on Protein Structure Function Relationship (eds. A. Abbasi and S. Abid Ali) BCC&T press, University of Karachi, 2003, p.145.

Role of proteins as biochemical markers for identification: New approaches for structural and functional taxonomy **-** S. A. Ali, M. Alam, M. Kamal, J. M. Alam and A. Abbasi, Proceedings of the 7th International Symposium on Protein Structure Function Relationship (eds. A. Abbasi and S. Abid Ali) BCC&T press, University of Karachi, 2003, p.179.

Purification and characterization of the recombinant human lens thiol transferase, F.Y. Qiao, N. Raghvachari, A. Abbasi, J. B. Smith and M.F. Lou, Proceedings of the annual meeting of Association for Research in Vision and Ophthalmology, 1998, p. 95

Identification of human lens γ−crystallins degradation products, J. B. Smith, A. Abbasi and D.L. Smith, Proceedings of the annual meeting of Association for Research in Vision and Ophthalmology, 1998, p. 183

Post-translational modifications of the lens crystallins associated with cataract, J.B. Smith, Z. Zhang, A. Abbasi, R.C. Barry and D.L. Smith, Proceedings of the Annual Meeting of the International Society for Eye Research, 1998

Prof. Syed Tajammul Hussain

Director, Nanotechnology laboratory,
National Center of Physics,
Quaid-e-Azam University,
Islamabad, Pakistan

PGD, MSc (UMIST), PhD (UMIST), PostDoc (Manc), PostDoc (Berkeley)

An International Nanotechnology Specialist (in Biomedical Applications)

Prof. Tajammul Hussain is well-known in Pakistan and throughout the world for his significant contributions in the fields of nanotechnology and nanoscience, with particular emphasis in biomedical applications. After training in some of the world's leading institutions in the field, such as UMIST, Manchester and Berkeley.

Prof. Hussain completed his graduate studies and doctorate as well as post-doctorate from the world-leading University of Manchester (at UMIST) and then proceeded to another post-doc at the world's top university, University of California at Berkeley & US Lawrence Berkely National Laboratory (LBNL). Since then he has worked with some of the world's very reputed institutions and laboratories, including Institute of Industrial Automation Control, Pakistan (1979-2000) and Westaim Corporation, Fort Saskatchewan, Alberta, Canada (2000-2005). In 2005 he joined the Nano-Catalyst Department at National Center for Physics, Quaid-e-Azam University, Islamabad, as its Director and Professor.

He has been a visiting professor with University of Alberta (Canada) since 2009, University Laval (Canada) since 2010.

He has published around 110 papers in peer-reviewed journals of international repute and holds about 15 patents in US and EU.

His area of research is Nano-Catalysts for energy, environment, biological and medical applications.

Prof. Syed Khurshid Hasanain

Chairman, Department of Physics,
Quaid-e-Azam University,
Islamabad

BSc (Hons.) & MSc (KU), PhD (Tufts)

A Leading Physicist in the Nation in Biophysical applications of Nano-technology

Prof. Khurshid Hasanain is currently the Chairman of the Physics Department, Quaid-I-Azam University, Islamabad and the Project Director for the Government of Pakistan project, "Development and Study of Magnetic Nanostructures". He did his M.Sc. from Karachi University and his PhD from Tufts University, Massachusetts, USA. After doing post-doctoral work at the Universities of Virginia and Rhode Island he returned to Pakistan in 1986 where he established the Magnetism and Superconductivity Laboratories.

In 1989 he was awarded the Salam Prize for Physics; in 1993 the TWAS Award of Young scientist of the Year, and in 2000 the Presidential Award of Pride of Performance. He is a Senior Associate of the International Centre for Theoretical Physics, Trieste and has been a visiting faculty at the University of Delaware, USA. He is also a referee for several international journals in magnetism and nanomaterials.

Prof. Hasanain's work has focused on the effects of structural, chemical and site disorders on themagnetic interactions. Since 2004 he has been involved primarily on the study of magnetic, transport and optical properties of nanomaterials particularly in nanoparticles and thin films. His own research group has facilities for Pulsed laser Deposition, Magnetometry, Optical and Dielectric Studies and Atomic Force Microscopy. He has produced over 75 international publications, and has supervised 7 PhD and 70 M. Phil. students. He has ongoing research collaborations with various international institutes where the finite size effects of nanomaterials are being studied with respect to both fundamental physics and possible applications.

Prof. Umar Dahot

Director, Institute of Biotechnology,
University of Sindh,
Jamshoro, Pakistan

MSc (Sindh), PhD (Sindh) and Post-Doc (Bonn)

One of the Pioneers & Leading Biotechnologists in Pakistan

Prof. Dahot did his B.Sc (Hons), M.Sc (Biochemistry) and PhD from the University of Sindh, Jamshoro, Pakistan (1989). His major was Biochemistry (Enzyme & Fermentation Biotechnology) and thesis was on biosynthesis of proteolytic enzymes by Penicillium expansum using rice husk as a carbon source. In terms of his postdoctoral trainings, he worked from April 20 to July 19, 1995 in the Institute of Organic Chemistry and Biochemistry University of Bonn, Germany under DAAD fellowship, followed by (from June 18 to July 30, 1997 & 6th July to 15th August 2001) in the Institute of Biochemistry and Biophysics, University of Tehran, Islamic Republic of Iran under University of Tehran fellowship, and then from 10th June 2004 to September 9, 2004 in the State Key Laboratory Bioreactor Engineering, East China University of Science & Technology, Shanghai, P.R.China.

He is a recipient of a number of awards, including Best University Teacher award of the year 2002 by Government of Pakistan, Fellow of Chemical Society of Pakistan (2005), and Gold Medal by the Ain Shams University, Cairo Egypt (2006).

He has successfully completed several research projects including two TWAS-sponsored projects and twelve national sponsored projects (PSF,HEC, UGC, NSRDB, UoS).He has so far advised 24 M.Sc.'s, 60BS's, 8M.Phil's and twelve Ph.D.'s.He has more than fifty international publications, around 150 national publications, 8 Reviews and one book.

He is an Editor with the Pakistan Journal of Biotechnology and a Member of Editorial Board, with the Science International, Lahore, Pakistan, and the Scientific Sindh, Annual Research Journal, Shah Abdul Latif University Khairpur, Pakistan.

Referee with a number of reputed journals in the world, including the Journal Chemical Society of Pakistan, Karachi, Pakistan, the Iranian Journal of Biotechnology, Tehran, I.R. Iran, Process Biochemistry, U.K., Scientific Sindh, SAL University, Khairpur, Pakistan, Mehran University Research Journal,Mehran University of Engineering & Technology Jamshoro, Pakistan, J. Biological sciences, India, Pakistan J. Biological science, Faisalabad, Pakistan, Asian J. of Plant Sciences, Faisalabad, Pakistan, and Process Biotechnology, USA

He is a member of several scientific societies, such as Life Member of Pakistan Society of Biochemistry and Molecular Biology, Life Member of Pharmacology Society of Pakistan, Life Member of Sindh Science Society, Pakistan, Life Member of Chemical Society of Pakistan,Life Member of Iran Society of Biophysical Chemistry, Islamic Republic of Iran, and Member Executive Council, Pakistan Society of Biochemistry and Molecular Biology.

Prof. Tashmeem Razzaki

Professor and Director, Stem Cells Laboratory,
Sindh Institute of Urology & Transplantation (SIUT), Karachi

BSc, MSc and PhD (KU), Post-Doc (Purdue), Post-Doc (CSHL)

Eminent Microbiologist and Pioneering Stem Cell Biologist in Pakistan

Professor Tashmeem did her doctorate in Microbiology from Karachi University and then proceeded to USA to do her Post-Doc from the world-famous Cold Spring Harbor Laboratory, USA, and Purdue University, West Lafayette, USA. She also spent some time as a Visiting Scientist with the leading laboratories in biological sciences at Rutgers University, USA, and University of Alberta, Canada.

After return she continued her career as a faculty member with Karachi University and had a successful career as a full Professor.

During her faculty tenure she not only set shining examples in teaching and research but also did pivotal efforts in establishing the Departments of Biotechnology and Molecular Biology at the University of Karachi and another Department at Shah Abdul Lateef University, Khairpur.

She later went on to join the team led by famous public figure and physician, Prof. Adeeb ul Hassan Rizvi at SIUT. At SIUT she has established Pakistan's first world-class Research Laboratory in Stem Cells Biology. She has numerous publications and research papers in refereed journals of repute and refereed international conference proceedings.

Dr. Masroor H. S. Bukhari

Visiting Foreign Professor (HEC)

MSc (Sind), DAS (Manc), PhD (Texas), Post-Doc (Texas)

Pioneering Young Biophysicist
& Interdisciplinary Science Advisor in
South Asia and HEC Invited Scholar to Pakistan

Dr Masroor H.S. Bukhari is one of very few scholars in the world with demonstrated expertise in two disparate but very important fields of research, particle physics and biophysics. He is interested in fundamental understanding of intrinsic bio-electromagnetism in living systems, ranging from unicellular organisms (such as yeast) to highly-complex and excitable cells, such as neurons in the rat cerebral cortex and hippocampus. In last six years he has extensively studied (using theoretical and experimental methods) various modes of interaction of RF electromagnetic radiations with living cell molecules *ex vivo*, *in situ* and *in vitro*.

Dr. Bukhari did his Masters in Physics (securing third position in class) from University of Sind Jamshoro and then proceeded to do Masters in Particle Physics on Manchester Overseas Science Scholarship Award at the legendary Schuster Laboratory, University of Manchester, England (working with the world-leading Prof. Robin Marshall FRS's HEP Group). On completion he moved to U.S. on a Graduate Research Fellowship Award at the University of Houston Texas, where he did his PhD in Nuclear Particle Physics and Postdoctoral in Biophysics. After completion of his studies he successfully obtained the status as a Licensed Medical Physicist in Texas. Later he did his research faculty tenures at various institutions such as the world-leading University of Texas MD Anderson Cancer Center, Houston and St Joseph's Medical Center, Houston.

On Higher Education Commission of Pakistan's invitation he returned to Pakistan as a Visiting Foreign Professor and worked at two new public universities. After two years he proceeded to Malaysia as a Visiting Professor with the oldest and leading university of Malaysia, the University Malaya, working with the Center for Low Dimensional Materials Research and Department of Physics. Currently he is a short-term visit HEC scholar at one of Pakistan's reputed public engineering universities, NED University, Karachi, and at the same time collaborator/advisor/visiting professor with the University of Houston, Texas, US Jefferson National Laboratory EMC Collaboration (Newport, VA), Science Advisory Board (Arlington, VA), University Malaya (Kuala Lumpur), University of Karachi (Karachi) and a number of reputed universities in the world.

Dr. Bukhari has around two decades of experience in physics and instrumentation research since an early age. He has around fifty peer-reviewed publications including three in the world's most prestigious physics journal, *Physical Review Letters*. His ISI Impact factor is 27 and holds a number of national and international awards and honors since young age.

Ms. Saman Hussain

Graduate Research Fellow,
Department of Cell Biology,
Harvard University,
Cambridge, Mass., USA
BS (Lahore), (PhD, Harvard)

A Bright Young Biophysicist of Pakistan

Ms. Saman Hussain completed her BS in Biology from the School of Science and Engineering, LUMS. She is now enrolled at Harvard University, pursuing a PhD in Engineering and Physical Biology. Her research interests are the cytoskeletal proteins actin and myosin. She has worked with some of the leading experts in this field such as Prof. Justin Molloy (National Institute of Medical Research, London) and Prof. Shahid Khan (Lawrence Berkeley National Laboratory, Berkeley). At young age, she has demonstrated a conspicuous potential in scientific research and critique with her brilliant efforts in the studies she undertook.

Her research focuses on the study of actin filament patterns powered by myosin motors in in-vitro systems. She uses techniques such as fluorescence microscopy and TIRF to study the spatial and temporal evolution of these patterns. She also uses image processing tools and is interested in developing algorithms that can analyze the data in a high throughput manner. The work is an interesting combination of theoretical, experimental and computational biology.

OPENING MESSAGES AND KEYNOTE ADDRESSES (PLENARY LECTURES)

SOM
Symposium Opening Message
By Chair at Large

Message by The Chair at Large

Biophysics and the Nano-world – Current Perspective & Future Vista's

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Various developments in physical methods in last five decades led to a vibrant era of nanoscience and nanotechnology, where tools were developed to probe nature at the nanometer scale. It turned out in last decade that the branch of science which received the greatest gift of these developments was biomedicine. Nanotechnology opened new vistas for biomedicine which could not be imagined before. Nano-probes, Nano-dots and nanoparticle arrays found a great niche in immunology and oncology, where these could be integrated with monoclonal antibodies and other cellular elements for diagnostics and therapeutics. Applications of nanotechnology range from living cell imaging to selective treatment of cancerous lesions.

I am pleased to see that there are a number of invited and contributed talks in this event which are in the domain of nanotechnology and its applications in biomedicine. I hope these talks will stimulate avid interest in the biophysics and engineering communities in the region and we could see significant development of the field here.

I send my best wishes to the field of biophysics in Pakistan and the participants in this important event and wish it all success. I also take this opportunity to congratulate the budding biophysicist community in the country for this great development, especially to my able colleagues like Shahid Khan (Berkeley) and Masroor Bukhari (University of Malaya and Pakistan Higher Education Commission), in promoting this field in the South Asia region.
I see a lot of potential and growth of this science in Pakistan which is bound to contribute to national growth in life sciences, especially in this era of biomedicine.

PL1
Keynote Address 1 – Plenary Lecture
Summary

Max F. Perutz Lecture

Molecular biophysics - a broad overview and a special case study: structure related to function of the salivary protein Statherin

Professor Paul Anderson, BSc (Biophysics), PhD (Biophysics),
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The aim of this biophysics lecture is to take the audience on a journey from a clinically relevant development problem, through the understanding of bio-mineralization events at protein bio-inorganic interfaces, then through the understanding of biophysical structural interactions of specific amino residues in a particular conformation, and then back though optimization using protein chemistry, and finally to make suggestions for biomimetic solutions to the clinical problems relevant to world health in the 21st century.

Understanding of protein structure is a requirement to unravel its function. This is a basic paradigm of biophysics. Alpha helices and beta sheets confer physical-chemical properties onto proteins into terms of binding sites, functional groups, or residue charge group directional functionality, conferring ability of the protein to operate.

To paraphrase the well-known English saying, “some proteins are structural, other proteins have structure thrust upon them”. The structure of many enzymes (for example) is intrinsic, and is fundamentally a consequence of their amino acid sequence. It is possible to predict this structure computationally, and in some cases confirm this by a variety of physical techniques including crystallography and NMR, for example. Other proteins have less intrinsic structure, and have little or no conformation in aqueous solution. It is possible however, for some of these proteins to acquire conformation on interaction with, for example, a surface. One such protein is the salivary protein statherin.

Statherin is secreted by the acinar salivary glands, has a sequence of 43 residues, with a highly charge N-terminal region. The function of this protein is to protect dental enamel from acidic attack. NMR studies and more recent synchrotron CD studies have shown that this protein has very little secondary structure ion solution, but, on binding to calcium hydroxyapatite (the principle inorganic component of bones and dental hard tissues) this protein gains an alpha-helical secondary structure.

The Biophysics Group at Queen Mary Dental School and colleagues have demonstrated that this protein inhibits hydroxyapatite dissolution by binding to its surface, acquiring structure, and then preventing the congregation and enlargement of dissolution sites on the hydroxyapatite surfaces. This dissolution inhibition mechanism by statherin significantly reduces the progress of enamel dissolution, and the development of dental caries within the oral environment. The function of this protein demonstrates the complexity of processes in biological systems of the biophysical chemistry, but can be translated to clinical applications too.

PL2
Keynote Address 2 – Plenary Lecture
Summary

Wilhelm C. Röntgen Lecture

"Biophysics in an age of convergence: Challenges and prospects"

Professor Ille C. Gebeshuber, Dip, PhD, PD [1, 2]

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Biophysics is a highly interdisciplinary science that uses the tools and methods ofthe physical sciences to study biological systems. On all levels of hierarchy, whetherinvestigating single biomolecules and their interactions on the nanoscale, whereall the natural sciences converge to one, or cells, or organisms, or the interactionof organisms, or the interaction of organisms with the environment, biophysicistsencounter beauty and expediency in the natural materials, structures and processes.

We currently live in interesting times: the tremendous amount of specialist knowledgethat is generated and published in various fields is getting out of hand. Too manypapers are published, in too much of a specialist jargon, to be of help to substantiallyadvance human society. Biophysicists, on the other hand, collaborate on a dailybasis with biologists, physicists, chemists, engineers and theoreticians and knowthe different inherent cultures and communication protocols in the respective fields– they therefore are good candidates to come up with a science language basedon deep understanding; a science language that is compatible across fields andlevels of education, and that furthermore aids transfer of scientific results to useful,sustainable applications - such as how to address increasing water and food challenges(concerning supply, quality, yield, shelf life), or how to provide living space for agrowing population.

The presentation will deal with biophysical approaches in contributing to successfullyaddress these challenges, and outline opportunities that arise from the methodology.

Based on detailed examples, promising ways forward will be presented in this 2012*Wilhelm C. Röntgen* Lecture.

PL3
Keynote Address 3 – Plenary Lecture
Summary

Francis C. Crick Lecture

Molecular Biology in the World of Today and the Essential Role of Biophysics

Professor Omar Bagasra, MS, PhD, MD

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My talk is to give a bird's eye view of the important and wide field of molecular biology and the essential role of biophysics in it. This is an inspiring talk for young faculty and graduate students to get them acquainted with the wonderful world of molecular biophysics and how it is changing the way we think and do medicine, experimental biology and computational biology. Starting with an overview of molecular biology and applications of biology, I would endeavor to develop a background of the audience in the field. Then I would attempt to build on this background by putting down the layers of modern problems in molecular biology and molecular medicine and how biophysics provides solutions to them.

INVITED LECTURES

IL1
Invited Lecture 1
Summary

J. D. Watson Lecture

Advanced Problems in Contemporary Molecular Biophysics and the Molecular Biophysics Consortium at The Lawrence Berkley National Laboratory

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Molecular Biophysics has seen a number of recent metamorphoses in last few years. There are some fundamental questions in cell and systems biology which depend on these developments and have led to numerous advanced problems in molecular biophysics. This talk will be able to give a short introduction to our program at MBC@LBNL, as well as my efforts to promote Biophysics in Pakistan and the South Asia region.

IL2
Invited Lecture 2
Summary

Walther H. Nernst Lecture

Y-doped titania-CNTs composite as an electrochemical biosensor for Lysine detection

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A composite of carbon nanotubes with yttrium doped titania particles (Y-doped TiO2-CNT) is synthesized and characterized using X-ray diffraction (XRD), scanning electron microscopy (SEM) energy dispersive X-ray (EDX) and Fourier transform infrared spectroscopy (FTIR). The electrochemical behavior of amino group (Lysine) is investigated by cyclic voltammetry (CV). The response mechanism of the synthesized biosensor is proposed to be the

combination of electrostatic and electrical interactions of CNTs with amino group. Excellent sensitivity, repeatability, stability, selectivity and recovery for the determination of amino group (Lysine) under optimized conditions are obtained. The potentiometric detection of amino group (Lysine) is in the range of 5mM to 25mM**.**

IL3
Invited Lecture 3
Summary

Hodgkin-Huxley Lecture

Effects of electromagnetic field on living systems, a biophysical approach at single molecule level in real time

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The rules that govern biological matters at single molecule level can be explained by the physics andelectronics of semiconductors that represent them as elements susceptible to electric, magnetic andelectromagnetic fields. All the constituents of the living systems can be compared with their electronicscounterparts. Cell membrane, for example can be considered as a capacitive element, ion channels as transistors, variable resistors and the source of potential differences across the membrane. Furthermore, each biological macromolecule acts as a polyelectrolyte whose function depends on its intrinsic charges, Columbic forces formed, and surrounding electrolytes, all dictating it's unique conformation. As a result the biological matter is a rather super complex system whose configuration at atomic level possesses temporal and spatial status that varies at sub-nanometer and femtosecond scales.

The dynamic of this system, even at molecular level is so complicated that makes it rather difficult if notimpossible to address by the available instruments. Thus, the main part of our understandings comes frommodeling approaches, where we simulate certain molecules to see their reaction to medium and certainphysicochemical stimulus at pico- to nano-second periods. In other words, obtaining a realistic picture ofwhat happening in living system at sub-molecular level is beyond our capabilities and might not possibleto understand in detail in near future. However, the very susceptible molecules are exposed to variouselectromagnetic fields, and claimed to be ineffective, while, only a few studies have addressed their realeffects at molecular level in real time.
Here, the physics of macromolecules implemented in ion channels will be discussed and the effects ofelectromagnetic fields studied at single molecule level on channel gating, voltage sensitivity, and conductance will be presented.

IL4
Invited Lecture 4
Summary

Nanophysics and its Biomedical Applications: The Potential and the Challenges

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The past decade has seen a dramatic progress in our ability to synthesize, understand, control and manipulate the aggregates of atoms at the sale of nanometers. This has led to the development of the field of nanoscience and nanotechnology which today promises to usher in an era of technology that may sound as alien today as the world of micro devices may have seemed fifty years ago. From molecular machines to nano-robots, from quantum dots to functionalized nanoparticles, from targeted drug delivery to location and treatments of tumors in the human body, an entirely new and breathtaking range of possibilities is emerging some of which are as yet far from realization while others are already in the market. A distinct feature of nanotechnology is its multidisciplinary nature where physics, chemistry, biology, material sciences etc. come together to deliver functionalized nanomaterials and nanostructures.

In the context of medicinal applications, nanoparticles, when designed to avoid the body's defense mechanisms, have beneficial properties that can be used to improve drug delivery. Where larger particles would have been cleared from the body, cells take up these nanoparticles because of their size. Complex drug delivery mechanisms are being developed, including the ability to get drugs through cell membranes and into cell cytoplasm. The small size of nanoparticles endows them with properties that can be very useful in oncology, particularly in imaging. Quantum dots (nanoparticles with quantum confinement properties, such as size-tunable light emission), when used in conjunction with MRI (magnetic resonance imaging), can produce exceptional images of tumor sites. In this talk we shall focus on one of the areas of applications of nanoscience viz. medical applications of nanoparticles with particular reference to magnetic and metallic nanoparticles in their role as highly efficient means of providing targeted drug delivery or as heating agents for burning out tumors locally. These goals require the overcoming of various challenges; the challenges of bio-compatibility of the magnetic and other types of materials; their stability, ability to be functionalized (to be attached to drug molecules or to encapsulate the drugs within them). To overcome these issues needs understanding the principlesof physics and materials science that underlie the unique properties of nanoparticles. These principles allow the nanoparticle properties to be tailored to suit the specific needs. In particular we shall describe the magnetic properties of nanoparticles e.g. their hysteresis and rotation processes etc. and their dependence on size, anisotropy and temperature and how these are tailored to meet specific needs.

We shall also look at the optical properties of nanomaterials that enable them to be used as markers of diseased areas or as contrast agents in Magnetic resonance imaging MRI imaging. Finally we shall discuss some of our own work and of others in materials such as magnetic oxides, alloy nanoparticles and hollow nanoparticles with reference to their application potentials.

IL5
Invited Lecture 5
Summary

Production, Purification and Characterization of Xylanase by Pleurotus eryngii And Effects of Various Parameters Such as Temperature

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Present research was conducted to produce xylanase enzyme by Pleurotus eryngii using different concentrations of local agricultural wastes/by products and sugars as carbon sources. The factors like temperature, pH and incubation time affected the xylanase production significantly at various levels of substrates. According to this study, it was observed that Pleurotus eryngii secreted the maximum amount of xylanase in 0.6% starch mineral medium at 302°C incubated for 96 hours, when pH was adjusted at 8.0 in comparison to other carbon sources.

Various organic and inorganic nitrogen sources (0.5 & 1.0%) were used in the fermentation study, such as $NaNO_3$, $(NH_4)_2$ HPO_4, KNO_3 and urea decreased the production of xylanase except corn steep liquor when Pleurotus eryngii inoculated in above mentioned nitrogen sources at 302C for 96 hours, pH was adjusted at 8.0. In the subsequent experiments 1% corn steep liquor was incorporated in the fermentation media throughout the study.

The enzyme was purified 1.44 fold by gel chromatography on Sephadex G-100 and 1.88 fold by Ion Exchange DEAE A-50 chromatography. The purified enzyme showed a high specific activity of 24.13 and 30.83 units/mg proteins by gel and ion exchange chromatography respectively. The molecular weight of the purified fractions was found to be 30 and 40 kDa by SDS-PAGE. The optimum pH and temperature for xylanase activity were 6.0 and 60°C, respectively. The enzyme was stable over the pH range 5.0-7.0 after pH 7.0 decrease in stability was observed and about 40% activity was retained when purified xylanase was incubated at pH 10.0 for 80 minutes. The enzyme was stable up to 60°C but increase in temperature reduces the enzyme activity. The temperature profile showed that purified xylanase retained maximum activity up to 60°C for 120 minutes and retain activity up to 44% when incubated at 100°C for 60 minutes. The enzyme activity was significantly stimulated by $ZnCl_2$ and $CaCl_2$ (5mM) up to 15% and 6% respectively. However, very little decrease in xylanase activity was observed in case of $ZnSO_4$. The purified enzyme was specifically most active on oat xylan and had a lower carbooxymethyl cellulose activity but very low xylanase activity towards substituted xylobiose, Avicil and starch was observed. It is concluded that the xylanase produced by Pleurotus eryngii can be used in paper and pulp industry.

IL6
Invited Lecture 6
Summary

McCulloch-Till Lecture

Stem Cells Biology & Biophysics: Past, Present & Future

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Life of a multi-cellular organism begins when a fertilized egg undergoes a couple of divisions to produce a few undifferentiated cells known as the embryonic stem cells (ESCs). Responding to molecular signals the primordial ESCs traverse various developmental trajectories to transform into adult stem cells which eventually give rise to all the tissues and organs of an adult organism.

This talk traces the discovery of the stem cells and their pivotal role in the development of the exciting inter-related fields of Regenerative Medicine and Tissue Engineering. While the fundamental understanding of stem cells is founded on molecular biology, the present and future excitement is about using the stem cells to cure metabolic and degenerative diseases. The promise of stem cells in translational medicine is not only tantalizing but has the concrete reality of having been successfully used in more than a hundred disease conditions with BMT being the most successful and time tested modality.

The interest in stem cells is not limited to biology and medicine but extends to diverse other areas such as biophysics, ethics, business and industry, and sociology to name a few.

Particularly in biophysics, stem cell biology has strong correlations with underlying physical processes which may facilitate or inhibit stem cell viability, growth and differentiation.

Our group is particularly interested in identification of new novel biomaterials which could act as three-dimensional scaffolds to facilitate stem cell growth and differentiation in the best manner possible.

IL7
Invited Lecture 7
Summary

Zafar H. Zaidi Lecture

Plant Proteins- Structural and Functional Implications in Health and Disease

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Proteins, the key elements of the biological machinery, are involved in a variety of functions such as modulation of the immune system, regulation and processing of hormones, protein degradation and processing, signal transduction, programmed cell death etc. in addition to the normal metabolic processes. Under conditions of pathogenesis, these biological regulators undergo changes altering immune response thereby facilitating invasion of tissues and cells in the host. The whole situation generates stress for the body affecting its functioning at large.

Plants provide a very good source of nutrition as well as defense for the human body. The active ingredients of these plants, which range from small molecules like ♑-amino butyric acid (GABA) to the large macromolecular assemblies like acetyl cholinesterase, superoxide dismutase, proteasome etc., are responsible for maintaining vital functions of life. Knowledge regarding the structure and function of the sources of energy and defense is the key to a healthy life. A literature search in this direction shows that very little attempt has been made towards identifying the active constituents. The present study is therefore an attempt to explore the biologically active components from plants reputed in folkloric medicine.

IL8
Invited Lecture 8
Summary

Max Delbrück Lecture

Life in the Mesoscopic Regime: An Exciting and Non-Quiescent Physical World With Great Potential for Future Biology

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This lecture is aimed at introducing the extremely important regime, the Mesoscopic world of living systems,to the scholars and students in both physical and life sciences. This is the region where classical effects seem to diminish and a quantum picture begins to emerge. A case is presented that just at the interface of microscopic and a nanoscopic world, the poised region of mesoscopic biophysics is an extremely dynamic physical world which has immense potential in cell and molecular biology. This is also a regime which gives rise to interesting phenomena which occur in the realm of physical chemistry, such as formation of molecular bonds and long-range bonding forces. Starting with an overview of mechanical forces involved at the mesoscopic scale (on the order of 0.1 to 1.0μm approximately), the talk discusses forces at work in driving the cell dynamics and various intrinsic processes and phenomena integral to a cell's life, survival and growth.

In second part of the talk, a brief discussion on quantum mechanical effects such as Quantum Mechanical Resonant Tunneling (QMRT) and evanescent waves is presented which could possibly take place in a cell at the mesoscale. It is argued that these processes could in principle facilitate information exchange within the cell in specific conditions.
Finally various aspects of the mesoscopic biophysics as well as the challenges encountered in this direction are briefly discussed. It is proposed that new cell imaging and analysis techniques aimed at probing this region could lead to substantial new and fundamental additions to our knowledge of living cells.

The talk is dedicated to the memory of one of the greatest and influential pioneering physicist-turned-biophysicists, *Max Delbrück*, in recognition of his great scientific discoveries as well as groundbreaking work on developing the important interdisciplinary field of biophysics.

Acknowledgment: Current support to author by the Higher Education Commission of Pakistan (under the SFHP Program) is greatly acknowledged.

IL9
Invited Lecture 9
Summary

Emergence of long range order in active actin gels

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Crowding behavior is an interesting phenomenon observed on all scales. Examplesinclude the flocking of birds, the movement of schools of fish and the formation ofbiofilms. We are interested in the nano-scale organization of actin filaments poweredby myosin motors. At low concentrations, actin filaments move randomly. Above acertain threshold, the filaments align and form patterns. This phenomenon was recentlydocumented by our group and others. Initially we used the Kuiper's Statistic (KP) toquantify angle independent population orientation.

This project aims to document the emergence of long range order. Population orientationas measured by KP increases with time as a first order reaction. I am also measuringthe complex patterns formed by actin filaments at different energy inputs and varyingfilament and motor surface densities. Cross correlation analysis is being used todefine spatiotemporal profiles. Inspection of individual filament-filament collisionshas revealed an angle bias towards alignment. This could be due to a weak attractionbetween filaments. The measurements serve as important constraints for development ofmechanistic theories.

Actin organization is essential for a number of fundamental cellular processes such as thefilopodial extension of dendritic spines. Our *in vitro* measurements should give insightinto these processes.

IL10
Invited Lecture 10
Summary

How to implement the teachings of nature?

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In the course of the last half century the concept of biomimetics has become ever more refined. Various sub-disciplines developed and found their way into the curricula of colleges, into R&D departments and influenced the way scientists investigate natural systems. However, very few researchers and engineers can integrate the knowledge and skills required to tackle the interdisciplinary field of biomimetics. In an attempt to team young graduates from a variety of academic backgrounds and to qualify them to overlook the field of biomimetics in energy systems, a homonymous M.Sc. program has been established at the Carinthia University of Applied Sciences. As few programs with a comparable approach exist so far, innumerable new approaches are likely to arise from the work of interdisciplinary groups striving to cross barriers that still exist between engineers and scientists, between developers and investors. One of the most crucial elements to the success of this endeavor is to bring together young, motivated and qualified people. Costly experimental effort, in contrast, can be minimized if existing knowledge and experimental data is re-evaluated. Keeping furthermore in mind that Pakistan, as well as many developing countries, possesses a great natural diversity makes this approach seem very well suited to boost innovation here.

IL11
Invited Lecture 11
Summary

Biomimetics in Energy Systems: Chances and Perspectives for an energetically sustainable Future

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One of the main global challenges of mankind in the coming century is the generation of sufficient amounts of sustainable energy to satisfy the rising hunger for energy in today's growing population and economy. With fossil fuels nearing depletion and high risks for the population and environment involved in the usage of nuclear power, new ideas and inspirations for energy generation are required for the transition into a brighter future.

One highly promising approach to solve this problem is the comparatively new science field of biomimetics, which is seeking inspiration from nature with the goal of transferring ideas and working principles to technological applications. During four billion years of evolution, only the most energy-efficient solutions prevailed and many of them may serve as role models for today's innovations. Apart from shaping organisms to ideally fit their surroundings, nature managed to develop a perfect sustainable cycle of energy transformation that relies on sunlight as the main power source. In this talk, some examples of biomimetic work will be shown and a possible transition path from the existing way we are using energy today to a sustainable, solar-power driven future will be drawn.

ORAL CONTRIBUTIONS
(SCIENTIFIC SESSIONS #1 - #6)

OC1

A new generation of MEMS in medicine to assist, enhance and expand human sensory perceptions

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The human body is equipped with various general senses: we can smell, hear, taste, touch, see, and sense temperature as well as ourselves (proprioception). These senses are of extraordinary value but we cannot change them even if this proves to be a disadvantage in our modern times. However, we can assist, enhance and expand these senses via micro-electromechanical systems (MEMS). Current MEMS cover the range of the human sensory system, and additionally provide data about signals that are too weak for it (in terms of signal strength) and signal types that are not covered by this system. In our interdisciplinary, biophysics-based approach existing MEMS sensor designs are modified and adapted (to keep costs at bay), via biomimetic knowledge transfer of outstanding sensory perception in 'best practice' organisms (e.g. thermoreception, UV sensing, electromagnetic sense). The MEMS are then linked to the human body (mainly ex corpore to avoid ethics conflicts), to assist, enhance and expand human sensory perception (artificial eyes, magnetic sense for facilitated orientation, etc.). Examples of created products comprise sensors that vibrate when a blind person approaches a kerb stone edge, devices that allow divers better orientation under water (echolocation, ultrasound), special glasses that allow vision in the ultraviolet range, vibrating devices on the steering wheel that inform car drivers of low fuel level, enhanced hearing capabilities (ultrasound, infrasound) and electromagnetic senses.

OC2

Radio-protective consequence of Amifostine on cells from cancer prone patients and healthy individuals studied by the G2 and PCC assays

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Amifostine has proven to be a potent cytoprotectant for normal tissues subjected to irradiation or to radiomimetic chemicals. Although Amifostine is currently used clinically, drug toxicity, limited times of protection, and unfavorable routes of administration, all serve to limit the drug's utility in

nonclinical situation. This study was aimed at investigating whether Amifostine is effective at reducing the yield of chromatid breaks when present during G(2)-phase irradiation of human normal cells and cells from cancer prone patients, as well as to study the mechanisms underlying the radio-protective effect of Amifostine.G(2) chromosomal radio-sensitivity in the presence or absence of amifostine was studied in healthy donors, cancer patients, ataxia-telangietasia (A-T) patients and five human lymphoblastoid cell lines with genes predisposing to cancer. The yield of chromatid breaks following gamma-irradiation in G(2) phase was obtained at the subsequent metaphase using the G(2) assay. For scoring chromatid damage directly in G(2) or G(0) phase, premature chromosome condensation was used.

It was observed that when Amifostine was present during irradiation, the mean yield of radiation-induced chromatid breaks as visualized by the G(2) assay was significantly reduced in healthy donors (t-test, $p=0.001$), in cells from cancer patients ($p=0.001$) and in cell lines from patients with genes predisposing to cancer ($p=0.01$) except ATM(-/-) ($0.1<p<0.2$). However, when chromatid breaks were scored directly inG(2) or G(0) phase using premature chromosome condensation, the presence of amifostine did not affect the yields obtained. In summary the result presented here may contribute in advancing our understanding of the selective cytoprotection of normal tissue by amifostine during radiotherapy. Amifostine reduces the mean yield of chromatid breaks in normal cells and in cells from cancer prone patients when present during G2 irradiation. Although the precise mechanisms of radioprotection caused by amifostine remain unclear, the results obtained using premature chromosome condensation reveal that amifostine does not act on cells just as a free radical scavengerbut also as a repair enhancer for damaged DNA.

OC3

Modulation by Cisplatin and Oxyplatin of mRNA Expression of a Selected Set of Genes in Colorectal Cancer Cell Lines

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Platinum based anti-cancer drugs are widely used to treat a variety of cancers. The drugs primarily act by binding to DNA and creating intra-strand cross links. The lesions obstruct the process of DNA replication. Cells have multiple repair pathways to fight back the damage and to prevent excessively damaged cells from replicating. This involves transcription of genes controlling growth and cell division, energy metabolism, repair and replication of DNA, apoptosis and other processes.We here report modulation of transcription of a selected set of genes by the two drugs in a panel of colorectal cancer cell lines.

Funding by SIUT is acknowledged.
(Authors report no conflict of interests or commercial designs)

OC4

Azadirachtin-related limonoids production through cell suspension culture of neem

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Neem based azadirachtin-related limonoids have received attention due to its biopesticidal and ecofriendly nature. Due to increasing its importance, present study was focused on *in vitro* production of these azadirachtin-related limonoids through cell suspension cultures of neem.First, highly proliferating calli were obtained from immature flowers of neem inoculated on Murashige and Skoog (MS) medium supplemented with 8.0% sucrose, 0.2mg/L of NAA, 1.0mg/L of each BAP and 2,4-D solidified with 0.3% phytagel and then cell suspension cultures were raised by inoculating calli in MS liquid medium supplemented with 3.0% sucrose, 0.2mg/L of NAA, 1.0mg/L of 2,4-D and 1.0mg/L of BAP.Azadirachtin-related limonoids production was enhanced by addition of various compounds and precursors like KNO_3, NH_4NO_3, $(NH_2)_2CO$, geranyl pyrophosphate (GPP) and isopentenyl pyrophosphate (IPP).The highest azadirachtin related limonoids (53.6mg/L) were produced in MS liquid medium supplemented with addition of 1.0mg/L of GPP followed by 50.2mg/L of azadirachtin contents in MS media containing 0.25g/L NH_4NO_3 on day 20 after inoculation. Similarly, improved production of azadirachtin related limonoids was also obtained with 45.2, 41.5 and 40.3 mg/L from by incorporating 1.0mg/L of IPP, 0.5g/L of NH_4NO_3 and 0.5g/L of KNO_3 in media respectively.

OC5

2D Synchrotron X-ray Diffraction Mapping of Dental Enamel Affected by Caries

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Objectives: Dental caries is a global problem affecting 60-90% of the population. The objective of this study was to understand the de-mineralisation process during caries and subsequent re-mineralisation by characterization of enamel crystallography. The method of synchrotron X-ray diffraction was applied to observe changes in enamel crystallite orientation comparing controlled de-mineralised and re-mineralised enamel to unaffected healthy enamel, working towards developing and improving treatments for caries prevention.

Methods: Synchrotron X-ray diffraction was used to evaluate the orientation of hydroxyapatite crystallites in enamel. Four types of tooth samples have been studied: 1) enamel with de-mineralised artificial lesion, 2) artificially re-mineralised enamel, 3) healthy control and 4) naturally carious enamel. Samples were treated with acetic acid then buffer solution to create lesions, before preparing 500µm sections. 2D X-ray diffraction patterns were collected on the XMaS beamline at the European Synchrotron Radiation Facility (ESRF). A 20µmx20µm beam spot was used to collect images at high resolution in order to detect changes across small areas of interest.
Results: 2D diffraction images have been analysed using Fit2D software. Variations in the intensity around the (002) reflection are indicative of texture in enamel. For each diffraction image, intensity was plotted against the azimuthal angle and fitted to a Gaussian peak. Changes in the Full Width Half Maximum (FWHM) were monitored from enamel surface to EDJ. In demineralized enamel, a systematic decrease in FWHM was seen from surface to EDJ, indicating a rise in texture. Both re-mineralised and healthy control enamel followed a similar trend of low FWHM at enamel surface.
Conclusion: The direct site of de-mineralisation results in a lack of texture and less orientation as compared to unaffected enamel. Similarities in higher texture observed in re-mineralised and healthy control enamel suggests that re-mineralisation may potentially restore crystallites to their original orientation.

Funding Acknowledgment: QMUL/MRC PhD studentship

OC6

Possibilities of Mutations in Growth Hormone Genes in Goat (*Capra hircus*)

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In this study growth hormone gene was amplified from goat *Capra hircus* and the PCR product obtained from the goat samples was successfully sequenced. The PCR product showed alignment on the *Caprahircus* gene at nucleotide number 1550 and matching continues till nucleotide number 1593 which falls in the intronic region. This implies that last 50 bases of the product lies in this region. The results account for the absence of the mRNA splicing event due to which the intronic region could not be spliced out and thus transcribed. The change in the sequence is detected from nucleotide number 220 of Growth Hormone gene which showed that the 73rd codon is changed, which lies in 2nd helix of GH tertiary structure. A number of factors can be responsible for the absence of the mRNA splicing event, such as the mutations in the donor or acceptor sequences, or the mutations in the Small nucleotide ribosomal binding proteins. These possibilities are discussed in this talk.

OC6

Potential role of Nano-oxides and their Complexed forms with Photosensitizers inPhotodynamic Therapy

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We studied the cytotoxic effects in Osteosarcoma (U2OS) cells to different nano-sized metallic oxides e.g. zinc oxide nano-rods (ZnO-NRs), MnO_2 nanowires (MnO_2 NWRs), Ferric Oxide nano-particles (Fe_2O_3 NPs) individually and their complexed forms with photosensitizers. Cell injury was assayed by cellular morphology, MTT assay, Reactive Oxygen Species (ROS) detection in dark as well as under UV-Visible laser exposed conditions. Plausible cell death with 50 µg/ml of Photofrin® under exposure of 30 J/cm^2 of laser was observed, while without UV, cells labeled with ZnO NRs had shown convincing loss in cell viability as compared to MnO_2 - NWRs and Fe_2O_3- NPs.

OC7

Aerosol drug delivery in human ETA through inhalers

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To accurately predict the flow in the complex geometry of the Extra-Thoracic Airway (ETA) is a daunting challenge. Comprising the oral and nasal cavities, the pharynx, the larynx, and the trachea the ETA presents a variety of cross-sectional shapes and diameters. The flow field in the extra-thoracic airway (ETA) is an important factor for the delivery of aerosols into the human respiratory system. Particles are entrained and transported by inhaled airflow. These flow fields will influence the deposition patterns of airborne pollutants and pharmacological drugs. Although therapeutic aerosols are carefully designed to allow optimal transport to the alveolar regions of the lung, in practice typically 80–95% of an orally inhaled dose is deposited in the extra-thoracic airways. This deposition decreases the delivery of medication to targeted lung tissue while increasing unwanted systemic effects. Minimizing ETA deposition is thus an important issue. The simulations for this case are done in FLUENT.

POSTER CONTRIBUTIONS
(FACULTY/GRADUATE-STUDENT SCHOLAR TIER)

EP01

Redefining quality- evaluating fruits through their intrinsic spectroscopic attributes

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At the present time, quality properties classification and evaluation of fresh fruits and vegetables is conducted to comply with the criteria of the official quality grades and standards based on the Codex alimentation of the Food and Agriculture Organization of the United Nations (FAO) and the World Health Organization (WHO). In Malaysia, the standard set by Federal Agricultural Marketing Authority (FAMA) also emphasize on the external attribute of the fruits such as size, colour, shape and percentage of visible defect on the fruits.

These quality standards are used for the national and international trade as a measure of the economically important fresh horticultural product. However, the current official product quality standard is based upon the subjective assessment which priorities the visual and external product attributes mainly to satisfy technological concerns of trade. Consequently, the product properties which reflect the growing consumer requirements relating to environmental, health and sensory benefits such as chemical composition are not considered.

Therefore, growers and distributors are now developing the specifications ahead of the legal quality, summarizing the relevant intrinsic properties that the consumers will accept: such as firmness, sugar and acid contents, aromas (juice content has been established as a comparatively standard measurement) and also vitamins. **A**ssessing these internal quality parameters of fruits usually involve destructive procedures and require much labour and time consuming. The application of spectroscopy is a promising tool in overcoming existing destructive measuring techniques.

From the existing literatures, the common focus of the current research on spectroscopy application for fruits intrinsic quality measurement is through spectrometer. The spectrometer is considered as universal optical instrument to measure varieties of biochemical composition of sample and has been applied widely for colour analysis. However, it is clear that specific biochemical composition actually responds better at certain wavelengths only. This has been proven by multiple experiments conducted previously. Thus, this research that arose from a multidisciplinary platform has been designed to fill in the gap between the existing literatures.

EP02

Ultrasound guided placement of gold fiducial markers in prostate: Institutional experience at Sindh Institute of Urology and Transplantation

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It is estimated that 50% of all patients who diagnosed with cancer in the world would currently benefit at some stage of their illness from radiotherapy. It is very essential to assure about treatment of cancer with radiotherapy that radiation is delivered at the exact tumor area of the patient. For this it is important to verify the treatment setup. Different institutional have different gadgets to conform the setup at the treatment couch of the machine like film based verification, EPID (Electronic portal imaging devise), Cone beam CT, IGRT etc. For the treatment of prostate cancer different studies show that, if we give higher doses to the prostate then we improve 5-years biochemical failure free survival. Investigator at MD, Anderson cancer center were among the first to recognize the potential clinical benefits of increasing the radiation dose to the prostate. Without verification of treatment side it is difficult to delivered higher radiation doses. Implanted prostate fiducial markers significantly improve precision of prostate radiotherapy. Our primary goal is to find accurate, better, safe and easy method to implant gold fiducial markers in prostate.

EP03

Current radiotherapy services in Pakistan and need for new facilities – A Review

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According to world health organization (WHO), International Agency for Research in Cancer (IARC) projection, by 2015 the global incidence of cancer will be 15 million each year of which 10 million will be from the developing countries. Pakistan is one of the developing countries which will be facing the burden of cancer patients very rapidly during next five years. The purpose of our study was to address the current status of radiotherapy facilities and other resources around the world, especially in Pakistan and developing countries. By utilizing these data we have attempted to achieve cost-effective solutions.

EP04

Treatment of Cancer by Using Radioactive Elements – An Overview

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There are many beneficial uses of ionizing radiation (Radioactive elements) in medicine for diagnosis and treatment of many diseases. Many radioactive isotopes in the world are used to diagnose and evaluate diseases or accidents. Because of the ability of radiation to kill cells, it has also been widely used in cancer therapy. Radioisotopes have found a large number of applications. Radioactive sources are used to study living organisms, to diagnose and treat diseases, to sterilize medical instruments and food, to produce energy for heat and electric power, and to monitor various steps in all types of industrial processes. One of them example is brachytherapy where we use Ir-192 for the treatment of cancer.

EP05

A Study on Problems & Constraints in Using Artificial Neural Network for Noise Removal from Gamma Images

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A novel idea is presented in this paper for the removal noise from gamma images of heart, liver, kidneys, lungs and brain, using an Artificial Neural Network (ANN). A sample size of 36 images was divided into training set containing 28 images and a test set holding 8 images. MATLAB 7.0 is chosen for this purpose. Recurrent ANN would be required which will classify the images as noisy and non-noisy when given as an input. It will then remove the noise either by processing again in the same network or sending it to image processing function. This removal of noise from gamma images will help in building up better understanding of the scanned regions of human body. Certain constraints have occurred due to which ANN could not be trained, which will be discussed in this paper.

EP06

Graphene in Biophysical Application - A Review

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When the minute fraction of mass behaves like a wave of energy it recruits dynamicity in the material and brings out various properties that include electronic, optical, and mechanical and others as well. These properties create the identity of material. Likewise, Graphene- a single, one-dimensional, layer of carbon atoms, possesses exciting features which make it a miracle material. In this review graphene's applications in the field of biophysics have been focused including bio-nano-sensing, neural signals sensing, bio imaging, drug delivery, gene delivery, cell culture scaffolds, blood compatibility and graphene's compatibility with biologically living cells.

EP07

A Biosensor based DNA Microarray Approach for cancers and mutation detection

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Every disease has a genetic evolution and they are transferred to generations in case of any mutation and damage to the genetic material. Environmental factors also play a key role in the spread of many toxic chemicals in different species and it depends on the adaptability of the individual that how the living system generates a response against an antigen. DNA/RNA is the main genetic materials that are responsible for many complexities if mutated. Thousands of genes and their products in a living organism function in a complicated or orchestrated way that creates the mystery of life. Genes express at a particular time under some specific conditions and they can be monitored. Today we have several methods to counter these problems by the use of Microbial sensing mechanisms and therapies. A Microarray constructed using an Oligonucleotide mapping of whole genome on a single microscopic slide may be a very simple and economical approach for the design of a biosensor that will take help from the living pattern of several genes to analyze protein expression and any abnormality in the functional protein that may cause cancer and can be detected on the basis of gene sequence similarity and Hybridization.

EP08

A Stochastic model for Electromyography

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Electromyography is a technique used for recording the electrical activity produced by skeletal muscles. These signals can be analyzed to detect medical abnormalities, activation level, and recruitment order to analyze the biomechanics of human or animal movement. The project mainly involved the completion of virtual implementation and simulation of optimal schematic with its hardware. The conclusive part had statistical analysis of the data to build a stochastic model for forecasting the risk of any muscular dystrophy in the subjects using parameters like family history, gender, age, and voltage versus time estimation of an EMG recorded from an individual muscle. Although the results observed are quite preliminary at this stage, the specificity of this model shows that it could be used for enhanced understanding of EMG waves and possible diagnosis of any muscular and neurological diseases using this method.

EP09

Purification of a salt-tolerant alpha amylase from bacillus strain NH-25

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To isolate and characterize enzymes useful for the processing of starches under high salt conditions, almost 400 bacterial isolates from coastal waters of Arabian Sea were screened for amylogenic activity. A bacillus isolate NH-25 was selected for further studies as it was found to grow at 55°C and tolerate up to 5M salt. The extracellular enzyme was purified by precipitation with ammonium sulfate, gel filtration, ion exchange and hydrophobic interaction chromatography. The molecular mass of the purified enzyme as estimated by SDS-PAGE and zymography is 45 kDa. The enzyme retains 60% residual activity after one hour at 50°C and is active over pH range 3.0-9.0. Calcium ions have stabilizing effect whereas PCMB has inhibitory effect on the enzyme activity.

EP10

Fractal analysis of reflective light patterns: a potential tool for biophysical and biochemical analyses

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Fractal analysis can be used to measure the complexity of reflected light patterns. This technique has great potential to be used as a measuring tool in biophysical and biochemical analysis. This technique can also be applied to other phenomena where light has to be measured. In terms of methods, photographs of random objects of different colours and textures, both absorptive and reflective in nature were used for analysis. Fractal analysis was performed using Box-counting method. Brightness Difference was calculated using standard RGB space. Pearson correlation was used to differentiate between the best set of data to study the relationship between light intensity and reflection clusters. Non-linear regression analysis was performed for functions, for which the relationship of variables was assessed based on norms of residuals, which was 0.05403 for a 7th degree polynomial fit. Data also fits inverse and cubic functions.

It is concluded that fractal dimension of reflected light for progressively increasing light behaves as a continuous function that fits almost perfectly with the data. Hence, this study develops a principle of analyzing the light reflection patterns for fractal dimension, which has many potential applications. The most important of such applications are biophysical and biochemical measurements.

EP11

Network motif discovery in protein interaction networks

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Protein interaction networks, or PINs, are simplified diagrams of actual protein-protein interactions taking place in the cell. In these networks, vertices are modeled as proteins and edges connecting them as interactions. Experiments have shown that such networks are made up of commonly repeating modules called Network Motifs that are based on repeating dynamic principles within the system. Such networks are found in significantly higher frequency than is expected for a random sub-graph and have many applications in therapeutics, diagnosis and also classification of new networks. To date number of network motifs have been discovered for diverse biological networks but protein interaction networks have not been studied in detail. In this review we highlight the techniques and softwares for discovering such network motifs in protein interaction networks and discuss their future direction and potential applications in Biology and Medicine.

POSTER CONTRIBUTIONS
(GUIDED STUDENT SCHOLAR TIER)

#ELIGIBLE ENTRIES FOR STUDENT PROJECT COMPETITION

SP01

Template assembly for Type III protein export

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Numerous bacteria especially pathogenic strains are motile and thus flagellated and bear distinctive flagellar machinery with no homologs yet found in its human hosts. This unique design offers itself as a potent drug target for sabotaging specific stages in bacterial pathogenesis. The groups of Drs Daniela Stock and Shahid Khan aim at determining the structure of bacterial flagellar motor's components, the various interactions amongst them and thus elucidating the premise assembly of all these constituents to drive the motor as a whole. A key component, a FliF forms a scaffold (the MS ring) onto which other components are mounted and thus provides the template for the assembly of primarily, the switch complex (FliG, M and N) and then the rest of the flagella. However, current knowledge of the structure presents an anomaly in the stoichiometry of these subunits, since the MS ring has been found to have a 26 fold symmetry and the C ring to have 34. This in turn raises the question whether there exists a symmetry mismatch or not.

The aim of this project is to co-express and purify FliF-G complexes and later on, the entire FliF switch protein complex (FliF-G-M-N) since these ring complexes are predicted to have greater stability and the expression of all the relevant components simultaneously would help to modeling natural conditions better. The goal is to then use these intact complexes from two representative species: Salmonella typhimurium and a thermophile Aquifex aeolicus (with rather thermally stable structures) and obtain well-ordered crystal lattices for X-ray crystallography (to be done at Stock lab). Alongside, mass spectrometry with the help of collaborators (CIB Robinson's lab in Oxford) will resolve the stoichiometry controversy and provide insight into its structure. Thus far, FliF complexes from Aquifex aeolicus have been overexpressed with cultures scaled up to several liters and solubilized in detergents (Triton X-100 and DDM) and some preliminary EM results of these protein complexes have been obtained. The next step is to clone tagged FliF- G proteins from Aquifex aeolicus into pETDUET vectors followed by optimizing expression levels, scaling up cultures and characterization of purified complexes by mass spectrometry, EM and hopefully crystallography. Finally, structures obtained, along with previously acquired experimental and bioinformatics data will be useful for homology modeling of bacterial flagellar motors from pathogenic bacteria.

SP02

Myosin II driven pattern formation of motile actin filaments

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Pattern formation dominates motion in several systems. The emergence of order in dynamic actin gels has recently generated interest. The project aims to study the correlation between the concentration of actin and the alignment of the filaments in one direction. It also aims to study the role of energy input in pattern formation, by varying motor densities. The analysis is being done using ellipse fitting in ImageJ and various computational algorithms have been developed in MATLAB to estimate the alignment while eliminating crossovers.These algorithms also take into account measures such as filament length, curvature, and minor axis. The dependence of alignment on time and the spatial correlation of aligned microdomains are amongst the other aspects of the system being scrutinized.

SP03

A Study on Important Analytical Functions Involved with Microscopy for Live Cell Imaging

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My work deals with enhanced image acquisition, analysis and basic image processing involved with compound microscopy for live cell imaging. I have attempted to explain in this report how basic features of a compound microscope, including its objectives, affect the lateral limit of resolution defined by the Rayleigh's criterion or the axial limit of resolution which is mainly a function of the Numerical Aperture (N.A.) of the lens, and put a diffraction limit to our images. It explains how does Modulation Transfer Function (MTF)-the ability to transfer contrast from the specimen to the intermediate image plane-changes as we increase the magnification. Lastly I have made an attempt to extract biologically meaningful information from images obtained via light microscopy using statistical tools, including Principle Component Analysis(PCA) toolbox. It is surmised that these factors significantly affect the quality of live cell imaging with compound microscopy.

SP04

An enhanced model of blood flow in the coronary artery bypass graftusing computational methods

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The Coronary Artery Bypass Graft (CABG) is the optimum modality to treat chronic coronary artery occlusion. There are two types of grafts used 1) Internal thoracic artery and 2) saphenous vein graft.

The Saphenous vein graft fails due to high amount of wall shear stress occurring at the anastomotic site of coronary artery and the graft. The condition used in this research papers are for quasi steady state condition and the geometry is also very idealistic. When we replicated this research paper, we were compelled to make few changes in the condition because our grid was different from research papers and our geometry was close to reality. We applied the solution in Ansys versions 12 and later to fluent 6.3.26 version. Both the soft wares were able to converge the solutions with almost the same result as given in the paper. We believe our work is better than other reported works because our geometry is close to reality and has achieved the same results with simpler assumptions.

SP05

A Study of Intrinsic Bioelectromagnetism with human DNA *ex vivo*

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There have been some reports in literature that intrinsic bioelectromagnetic activity was observed in some forms of bacterial and viral DNA in various concentrations (including heavy dilutions). We report absence of any kind of intrinsic bioelectromagnetism recorded from human DNA in our preliminary experimental studies, except some intrinsic noise coupling as exhibited by concentrated DNA in which the nucleotide suspension was seen to couple to ambient EM noise. A calculation is also presented which supports our observations that it is virtually impossible to physically detect any low frequency RF electromagnetic fields (distinguishable from thermal noise or ambient electromagnetic fields and falling within the spectral range of 10Hz-10KHz) from DNA, whether pure, diluted or treated with any chemical substance (such as anti-viral chemicals) with inhibitory/excitatory effect on DNA/RNA. Various aspects of the problem are discussed in this report. We suggest that the only possibility nucleotides could be associated with intrinsic electromagnetic fields would be with much higher frequencies in the microwave region and under some pertinent physical resonance mechanism within the clusters of nucleotides. More detailed and sophisticated studies are needed to further confirm the findings reported herein.

Support to MHSB from the SFHP Program of the Higher Education Commission of Pakistan is duly acknowledged.

(Authors report no conflict of interests or commercial designs)

SP06

Inducement of hypothermia in human neonates as a treatment for birth asphyxia –biophysical basis and prospects for clinical implementation

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Numerous studies have been carried out in recent years to determine the various causes of mortality in early neonates (infants less than 7 days old – as per WHO). Research has shown that birthasphyxia is responsible for approximately 0.92 million neonatal deaths and a further 1.1 millionintra-partum stillbirths annually (*Bull. WHO* 2005, 83:409-417), and is one of the most primarycauses of infant deaths. According to one study (Jehan *et al.*, 2009), 19.5% of neonatal deaths inurban Pakistan can be attributed to birth asphyxia or hypoxia; however, a study by NICHD (lastupdated, 2011) showed that cerebral cooling initiated within 6 hours of birth and continued for 72hours would reduce the risk of death, and moderate to severe neuro-developmental injury at 18-22months corrected age. This paper aims to follow up on this (last quoted) research, and design an economically viable solution for the induction of hypothermia in neonates, working from firstprinciples and with a critique on possibility of clinical implementation.

SP07

Effect of Low-Intensity Pulsed Ultrasound on Satellite Cells

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This is a strategy paper aimed at studying effects of *Low-Intensity Pulsed Ultrasound (LIPUS)* on satellite cells. LIPUS is a medical technology, which utilizes 1.5 MHz frequency pulses, a pulse width of 200 μs, repeated at 1 kHz frequency, at an intensity of 30 mW/cm^2, with an exposure rate of 20 minutes/day. The purpose of our study is to determine how the Satellite cells respond directly to LIPUS stimuli; whether the specific stimuli would bring about a resultant proliferation, leading to nerve regeneration, or apoptosis should occur. After sciatic nerve lesion, the rate of axonal regeneration is reduced and ultimately leads to neuronal death i.e., apoptosis and necrosis. A range of events is initiated on peripheral nerve lesion. It is also an initial morphological step in a cascade of events which will be responsible for neuronal survival as well as axonal regeneration, or for neuronal death, which can occur by apoptosis or necrosis. During the interval before cell death, however, LIPUS stimuli will have to be introduced and necessary measurements to be carried out.

Support to MHSB from the SFHP Program of the Higher Education Commission of Pakistan is duly acknowledged.

(Authors report no conflict of interests or commercial designs)

SP08

Presenting an enhanced NMR spectrometric technique using Halbach magnet arrays

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Nuclear Magnetic Resonance (NMR) has great magnitude of applications in life sciences, ranging from NMR spectroscopy in biology, biophysics and biochemistry to Magnetic Resonance Imaging (MRI) in medicine. Moreover, it has enormous potential for various applications in industry as an on-line or at-line test control device for process environments. A single sided NMR with Halbach geometry gives superior advantages of field concentrated within its center and light weight. NMR *Mandhalas* (magnetic arrangement for novel discrete Halbach layout) are arrays of identically shaped magnets oriented in Halbach-type arrangement, resulting into a homogenous magnetic field over larger values. For this purpose formulae and numerical values are calculated based on dipole approach to obtain flux density of single rings and then converted ino three dimensions. Ideal Halbach magnets, which are positioned and oriented in actual usage are based on solving analytical equations. A geometry of sixteen magnets provides good strength for performance and special requirements. The construction of these arrays requires the design of delicate support frames and procedure to mount them. This paper presents a preliminary design for an enhanced spectrometric technique based on Hallbach magnet arrays. Factors such as moisture absorbance can also be observed from the echo amplitude of NMR spin echo signal.

Support to MHSB from the SFHP Program of the Higher Education Commission of Pakistan is duly acknowledged.

(Authors report no conflict of interests or commercial designs)

SP09

An Enhanced Celsion Adaptive Thermodynamic Therapy (TDT) Paradigm

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Cancer has been dreading this world for long and various methodologies are adopted to combat this disease. Some of these include, in particular, to restore the ability of cells to apoptose and thus stop the abnormal and uncontrolled growth. One of the recent studies in this direction, in the regime of biophysics is by considering cell as a thermodynamic system and then observing metabolic changes. Some other novel approaches include increasing the absorption capacity of chemotherapeutic drugs in only the targeted cells with aim to induce cells into apoptosis.

One of such successful experimental techniques recently introduced is the *Celsion Adaptive Thermodynamic Therapy (TDT)* drug delivery system for treating deep-seated cancers. Hyperthermia works very effectively to produce enhanced response of malignant cells when combined with chemotherapy without increasing the amount of drug. It is induced by electromagnetic energy absorption within the tissue where heat is applied. This applied heat is tapped to elevate drug uptake in tumor sites, causing damage to the cell membrane of malignant tumors and finally causing the cell death.

Lipid based vesicles *(liposomes)* have been playing their part as drug carriers but they are less efficientdue to their slow release and ineffective delivery of chemotherapeutic agents to the malignant tissue.Therefore, for deep-seated tumors thermo-sensitive liposomes are adopted as drug carriers which deliverdrug selectively to the heated tissue region. Though various liposome formulations have been introduced and drug delivery is made more effective, there is need for improvements in techniques for heating the malignant tissue, causing least harm to the non-affected living tissues and organs.

This paper presents the overview of a celsion adaptive TDT technique and it is suggested that it could serve as a viable and enhanced alternative in clinical implementation. In this technique, phase adaptive radio frequency is used to heat the affected area. High-intensity focused ultrasound has focused on increasing the size of the ablation zone and minimizing heat-sink effects therefore RF can be replaced by high frequency ultra sounds for more effective results. We believe that our suggested approach will allow increased consistency in treatment delivery and will facilitate translation to the community setting.

SP10

Translation and the computational microscopy paradigm – a case study

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Translation is one of the important processes of protein synthesis in the cell which plays a vital role in biological system. The basic organelle which causes the protein synthesis is ribosome, a biological machine. Biological molecular machines span a range of sizes, from the 80-°A-sized helicases to the 250-°A-sized ribosome. Many techniques have been brought to bear on the problem of extracting the structural and functional details of molecular machines such as ribosome e.g. X-Ray crystallography, cryo-electron microscopy etc. The ribosome is a large dynamical machine .The main purpose of the complex ribosome machinery is to catalyze fundamental reactions. Molecular dynamic simulation methods and recent advances in them can now tackle systems involving millions of atoms at scales ideal for studying ribosome function. Molecular dynamics were used to form simulation of ribosomes and conformational changes occurring within molecular levels. Different functional aspects of ribosomes have been observed using computational microscopy.MD simulations have made notable contributions to the illumination of the mechanistic aspects of translation by the ribosome. Today, MD simulations covering the milli-second (ms) time scales are becoming feasible. Additionally, MD can serve purposes other than pure simulation of dynamic processes. MD can also aid in the combination and interpretation of disjoint experimental data, a purpose which has no inherent time scale, through, e.g., molecular dynamics flexible fitting (MDFF). Advancement in understanding of how the ribosome functions will continue to be attained through traditionally applied methods, such as the determination of new structures and pure MD simulations. However, it appears likely that it will be at the interface of different methods where an increasing number of advances will be made. Computational modeling, simulation paradigm in particular, is well poised to provide a means to integrate data from multiple sources. Such integration is already taking place for crystallographic structures and cryo-EM data, merged via MDFF simulations. This integration is providing views of functional states of the ribosome previously unseen at atomic resolution. Visualization of these states, and knowledge of the dynamics connecting them, can reveal how even the smallest components of the ribosome serve their part in the operation of the entire molecular machine. The computational microscope, not built from brass tubes and glass lenses, but based on general chemical knowledge, principles from physics, well-selected mathematical algorithms, efficient and easy-to-use software, ever improving computer hardware and, last but not least, intuitive computer graphics, will play an increasingly important role in future studies.

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