BIOGRAPHICAL SKETCH

.

NAME:	SYAMANTAK KHAN
POSITION TITLE:	POSTDOCTORAL RESEARCHER, STANFORD SCHOOL OF MEDICINE

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE *(if applicable)*	Start Date MM/YYYY	End Date MM/YYYY	FIELD OF STUDY
Indian Institute Of Technology, Kharagpur, India	Bachelor of Technology (B. Tech.)	06/2007	05/2012	Biotechnology
Indian Institute Of Technology, Kharagpur, India	Master of Technology (M. Tech. Dual degree)	06/2007	05/2012	Biotechnology, Molecular Biology,
Indian Institute Of Technology, Mandi, India	Doctor of Philosophy (Ph.D.)	08/2014	01/2018	Nanoscience, Single molecule spectroscopy

A. Personal Statement

I am a postdoctoral researcher at Stanford medical school. My primary research interest is in-vitro modeling of cancer and cancer metastasis using a microfluidic platform. I am interested to use the organ-on-a-chip technology to create patients' tumor-on-chips to facilitate therapeutic screening. Since my Undergraduate and masters studies, I have been drawn to the fascinating biology of cancer progression. My engineering degree (B.Tech. & M.Tech.) in Biotechnology from Indian Institute of Technology Kharagpur equipped me with unique skill sets to study cancer biology with innovative engineering approaches. I have also gathered enriching experiences in current state of art high resolution microscopic and spectroscopic techniques during my doctoral studies. This provides me the unique ability to develop new technologies in cancer diagnosis and therapeutics using in-vitro modeling approaches of tissue engineering. With the recent use of microfluidic platforms to reconstitute organ level function, I realized the tremendous potential of this technology to model tumor microenvironment and cancer progression. My future and long term goal is to contribute to the development of precision therapy in cancer patients, as cancer progression and clinical response to therapy widely varies across the patients. After spending more than 8 years in various scientific research fields, I found an exciting opportunity to work on Cancer in Pratx lab at Stanford. I am determined to use this great opportunity to bring the best out of me to succeed and devote myself to cancer research. Prostate cancer, being a leading killer in men, is my future research focus and I actively look forward to opportunities which can help me develop a scientific career in prostate cancer.

B. Positions and Honors

2012-2014	Research Associate at Indian Institute of Technology, Mandi. India
2016	Guest Scientist at Third Institute of Physics, Georg-August-University, Germany
2018	Postdoctoral Fellow at Georg-August-University, Germany
2018-Present	Postdoctoral Researcher at Radiation Oncology, Stanford University

C. Contributions to Science

PUBLICATIONS:

1) S. Khan, A Gupta, N C Verma, C K Nandi, Time-Resolved Emission Reveals Ensemble of Emissive States as the Origin of Multicolor Fluorescence in Carbon nanodots. *Nano Lett.,***2015**, 15, 8300–8305 (American Chemical Society, Impact Factor:12.7)
2) S. Khan, W. Li, N. Karedla, J. Thiart, I. Gregor, A. M. Chizhik, J. Enderlein, C. K. Nandi, A. I. Chizhik, Charge-Driven Fluorescence Blinking in Carbon Nanodots. *J. Phys. Chem. Lett.,***2017,** 8, 5791-5757 (American Chemical Society, Impact Factor: 9.4)
3) S Khan, A Gupta, C K Nandi, Controlling the fate of protein corona by tuning surface properties of nanoparticles, *J. Phys. Chem. Lett.,***2013**, 4, 3747-3752. (American Chemical Society, Impact Factor:9.4)
4) S. Khan, A. Sharma, S. Ghoshal, S. Jain, M. Hazra, C. K. Nandi, Small Molecular Organic Nanocrystals Resemble the Properties of Carbon Nanodots, *Chem. Sci*., 2018,9, 175-180. (Royal Society of Chemistry, Impact Factor 8.7)
5) S. Khan, N C Verma, C K Nandi, Reversible Photoswitching of Carbon nanodots *Sci Rep*, **2015**, 5, 11423. (Nature Publishing Group, Impact Factor:4.3)

6) S Khan, A Gupta, A Chaudhary, C K Nandi, Orientational switching of protein conformation as a function of nanoparticle curvature and their geometrical fitting, *J. Chem. Phys.*, **2014**, 141, 084707.
7) S Khan, A Gupta, N C Verma, C K Nandi, Kinetics of Protein Adsorption on Gold Nanoparticle with Variable Protein Structure and Nanoparticle Size, *J. Chem. Phys.***2015**, 143, 164709.
8) S. Khan, C. K. Nandi, Optimizing the underlying parameters for protein-nanoparticle interaction: advancement in theoretical simulation, *Nanotechnol. Reviews,* **2014,** 3, 347-359
9) S. Khan, S Samanta, R. Sen,S. K. Ghosh, Bacillus coagulans strain RK-02 cellulase gene, complete cds, **2011,** *GenBank: JQ288744.*
10) S Khan,* N C Verma, C Rao, C K Nandi, Carbon Dots for Single-Molecule Imaging of the Nucleolus ACS Appl. Nano Mater., 2018, 1, 483–487(*as a co-corresponding author)
11) C Rao, S Khan,* N C Verma, C K Nandi, Labelling of Proteins with Carbon Nanodots. *Chem. Bio. Chem.* **2017,** 18, 2385-89. (*as a co-corresponding author)
12) A Chaudhary, A Gupta, S Khan, C K Nandi, Morphological effect of gold nanoparticles on the adsorption of bovine serum albumin, *Phys. Chem. Chem. Phys.*, **2014**, 16, 20471-20482
13) A Gupta, A Chaudhary, P Mehta, C Dwivedi, S Khan, N C Verma, C K Nandi , Nitrogen Doped Thiol Functionalized Carbon nanodots for Ultrasensitive Hg (II) Detection, *Chem. Commun.*, **2015**, 51, 10750-10753.
14) A Gupta, N C Verma, S Khan, S Tiwari, A Chaudhary, C K Nandi, Paper strip based and live cell ultrasensitive lead sensor using carbon nanodots synthesized from biological media, *Sensors and Actuators- B*, **2016**, 232, 107-114.
15) A Gupta, N C Verma, S Khan, C K Nandi, Carbon nanodots for Naked Eye Colorimetric Ultrasensitive Arsenic and Glutathione Detection, *Biosensors and Bioelectronics*, **2016**, 81, 465-472.
16) A Chaudhary, S Khan, A Gupta, C K Nandi, Effect of surface chemistry and morphology of gold nanoparticle on the structure and activity of common blood proteins. *New J. Chem,***2016**, 40, 4879-4883.
17) NC Verma, S Khan, CK Nandi, Single-molecule analysis of fluorescent carbon dots towards localization-based super-resolution microscopy, *Methods and Applications in Fluorescence* 4, 044006.

INVITED TALKS:

1. 'Structure and properties of fluorescent carbon nanodots" - Advanced Functional Material Conference, University of California, Los Angeles, 17 August, 2017
2. 'A whirlwind trip to IIT Mandi'-Invited talk, Third Institute of Physics, University of Gottingen, 31 May, 2016
3. '*Fluorescent Carbon Nano dots – The mysterious Nanolights*' - Research Fair, IIT Mandi, 27 Feb, 2016
4. 'Science beyond size limit – from Nanoparticle to Nanoscopy'- AMRC Symposium, IIT Mandi 30 May, 2015

RESEARCH PROJECTS:

1. Bachelor thesis:(Department of Biotechnology, IIT Kharagpur, 2010-11):
   Title: Synthesis of folate-decorated chitosan nanoparticles for efficient drug delivery in amoeba.
   Abstract: Nanoparticles were prepared by modifying chitosan molecule and tagging it with folic acid. The structure was confirmed by FTIR spectroscopy and the particle size was measured by DLS analysis. These nanoparticles are biocompatible and biodegradable semisynthetic polymers. Metronidazole was the used drug which was incorporated inside this man-sized vehicle. The drug entrapment efficiency was optimized to 30%. The nanoparticle conjugated drug was found to be very efficient when tested on *Entamoeba invadens* cells.

2. Master Thesis: (Department of Biotechnology, IIT Kharagpur, 2011-12):
   Title: Chitosan nanoparticle mediated dsRNA delivery for gene silencing in *Entamoeba histolytica*
   Abstract: Nanoparticles were prepared by ionic gelation of TPP and chitosan. FTIR spectroscopy, DLS analysis, zeta potential distribution and Transmission Electron Microscopy were used to characterize the particles. These particles were fluorescent tagged with FITC and *Entamoeba histolytica*cells were treated with them. Confocal microscopic analysis proved those particles to be extremely effective transport vehicle though the membrane of *Entamoeba histolytica* cells. The dsRNA gene silencing cassette (prepared previous in our lab) was successfully entrapped by absorbing the RNA on the surface of the particle. This entrapment efficiency was maximized up to 70%. This conjugate will be applied to *Entamoeba histolytica*in future for silencing of a particular encystations specific gene which will be checked by RT PCR analysis.

3. Summer Research Project:(IIT Kharagpur, 2010-12):
   Title: Cloning, expression and characterization of a novel cellulase gene from *Bacillus coagulans* RK-02
   Abstract: A cellulase gene from Bacillus coagulansRK-02 was cloned into E.colibacterial system. The primer was designed based on gene sequence of Bacillus Subtiliswhich have the cellulase gene CelL73 and CelL15. Only one of the two genes was amplified and was subsequently expressed in E.coli. Bioinformatics analysis including conserved domain search, homology modelling and phylogenetic study helped to characterize the protein. The recombinant protein was found to be enzymatically very active. Its cellulolytic activity was measured by clearing Zone assay and CMCase assay. Bioinformatics analysis has been done for the characterization of the protein.

4. Research Associate (IIT Mandi, 2012 - 2014):
   Topic: Understanding the molecular interactions of human proteins and gold nanoparticle
   Abstract: The modern trend of Nano-medicine research finds its greatest obstacles for applied nanoparticles to be the formation of protein corona around them and the failure to evade immune system. In the root of the both, there lies our ignorance of protein nanoparticle interaction. This particular field is a centre of focus now a days and different approach are being made to understand this illusive area. My current study includes computer simulation methods to recreate the proteins and gold surface and investigate the driving forces which govern the association. To simulate the actual environment we considered different ranges of surface modifications and searched for the parameters which are decisive in reality. We found specific surface modifications can entirely change the protein binding on the gold

surface and the pattern is consistent with number of human proteins including, serum albumins, haemoglobin, insulin, transferrin, ubiquitin etc. The findings are also very consistent and complementary with the experimental data previously found by our research group. We also used a range of hypothetical surface modifications to consolidate our understanding.

5. Doctoral Thesis (IIT Mandi, 2014-2017):
   Title: New Insights into Carbon Nanodots: Analysis of Ensemble and Single Molecule Fluorescence.
   Abstract: Fluorescent carbon nanoparticles, also known as carbon nanodots, are the new member of carbon family. They have been proved useful in diverse applications including bioimaging, drug-delivery, molecular sensing optoelectronics and photovoltaics. However, the mechanism of photoluminescence is yet not understood clearly due to unavailability of the structural detail. Their excitation dependent emission, which gives rise to multicolour emission, has also remained elusive till date. They have been extensively used as an imaging probe in live cells due to their non-toxic nature. But precise labelling of specific bio-targets has never been achieved as they non-specifically bind to all cellular structures. These are the major challenge for advancement in the field of carbon nanodots towards finding their industrial scale applications. This thesis aims to address the above unsolved problems with a range of in-depth experimental investigations from ensemble to single molecule level. Time-resolved spectroscopy of carbon nanodots reveals multi-emissive states which give rise to excitation wavelength dependent fluorescence emission. Single particle fluorescence analysis at room and cryogenic temperatures reveals that charge trapping at the various surface functional groups of carbon nanodots control their photoluminescence. This knowledge led to the successful single molecule imaging of nucleolus of human cancer cells which were specifically labelled with carbon nanodots. Finally, this thesis addresses the common fallacies in this field of research. The classical concepts of graphitic carbon core, hetero-atom doping and particle heterogeneity were revisited in the light of molecular fluorophores and organic nanocrystals, mimicking carbogenic nanoparticle.

6. Visiting Scientist University of Goettingen (2016 Summer):
   Topic: Investigation of the origin of fluorescence blinking of single carbon nanodots.
   Abstract: Advanced time-resolved fluorescence spectroscopic study of single carbon nanodots was performed in a wide temperature range. Carbon nanodots were found to blink (emission) according to the power law at both room and cryogenic temperatures without change of their excited state lifetime. The average on-time was found to be significantly elevated at lower temperature. The findings, presented in this chapter, advance our understanding of the fluorescence mechanism of carbon nanodots and extend their application for super-resolution imaging.

7. Post-Doc at University of Goettingen (2018):
   Topic: Quantum Yield measurement of semiconductor quantum dots (QDs) in an optical nanocavity.
   Abstract: Single molecule quantum yield measurement is a challenging task. We were using a recently developed nanocavity based system to measure the quantum yield of QDs by tuning the length of the cavity. The project was aimed to apply electric field in the nanocavity to mimic the axon potential in neuron cells for voltage sensing application of specially designed QDs.

8. Post-Doctoral Researcher at Stanford University (2018-Present):
   Title: In-vitro bio-mimetic models of cancer and cancer metastasis
   Abstract: My current research in Pratx Lab at Stanford University is aimed at developing in-vitro models of cancer for the development of novel diagnostic and therapeutic approaches. We are currently using microfluidic platform for 3D cell culture. Additionally patient derived tumour organoid models are combined with microfluidics platform to develop a tumour-on-a-chip device. We aim to develop tumour vasculature in the organoid culture and model intravasation to create in-vitro circulating tumour cells.

D. Additional Information: Research Support and/or Scholastic Performance

YEAR	COURSE TITLE	GRADE
2014-2015	DNA NANOTECHNOLOGY	EX
	QUANTUM CHEMISTRY	A
	CHEMICAL THERMODYNAMICS AND ELECTROCHEMISTRY	A
2011-12	TRANSGENIC TECHNOLOGY	A
	R-DNA TECHNOLOGY	B
	R-DNA TECHNOLOGY LABORATORY	B
	CELL & HYBRIDOMA LABORATORY	A
	GENE EXPRESSION	A
	SECONDARY METABOLISM IN PLANTS & MICROBES	B
	IMMUNOTECHNOLOGY	A
	SPECTROSCOPY - II	A
	BIOTECHNOLOGY OF PLANT METABOLITES	B
	METABOLIC ENGINEERING	A
	BIO-MECHANICS	EX
2010-11	PARTIAL DIFFERENTIAL EQUATIONS	A
	TRANSFER AND MANAGEMENT OF RURAL TECH	EX
	BIOINFORMATICS	B
	IMMUNOLOGY	B
	PROTEIN ENGINEERING	B
	PLANT CELL & TISSUE CULTURE LABORATORY	A
2009-10	GENETICS	A
	NEUROPHYSIOLOGY	A
	ANALYTICAL BIOCHEMISTRY LABORATORY	B
	GENETICS LABORATORY	A
	CELL & MOLECULAR BIOLOGY	B
	CELL & MOLECULAR BIOLOGY LABORATORY	A
	BASIC ELECTRONICS	A
2008-09	MICROBIOLOGY	B
	BIOCHEMISTRY	C
	BIOCHEM. REACTION ENGG. AND BIOENERGETICS	A
	BIOCHEMISTRY LABORATORY	A
	MICROBIOLOGY LABORATORY	A
	BIO-PROCESS ENGINEERING LAB	A

Grades: Ex = 10/10, A = 9/10, B = 8/10, C = 7/10, D = 6/10, P = 5/10,