

## VITAE\_Sandip Banerjee



**NAME:** Sandip Banerjee  
Designation: Associate Professor

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**ADDRESS:**

Home (present): B-502 Canal View  
Apartment, 39, Civil Lines,  
IIT Roorkee, Roorkee – 247667,  
Uttarakhand, India.

Office:  
Department of Mathematics  
Indian Institute of Technology, Roorkee  
Roorkee – 247667, Uttarakhand, India.

**DATE OF BIRTH:**

October 19, 1969

**CITIZENSHIP:**

Indian

**EDUCATION**

- Ph.D. in Applied Mathematics, March 2001, University of Calcutta, India.
- Master of Science, Applied Mathematics, December 1993, University of Calcutta, First Class.
- Bachelor of Science, Mathematics (Honors), St. Xavier's College, August 1991, University of Calcutta, First Class.

**RESEARCH INTEREST**

- Mathematical modeling of interaction between tumor and immune system – the spatial aspect and its 3D visualization.
- Mathematical modeling of plankton dynamics in patchy stochastic environment.
- Ecological dynamics of interacting populations, mainly, effects of space and stochasticity.
- Stage Structured predator-prey interaction with counter-attacking and parental care

## **TEACHING INTEREST**

### **Undergraduates:**

- Analytical geometry of 2 and 3 dimensions.
- Vector algebra and vector calculus.
- Kinematics of 2 and 3 dimensions.
- Numerical methods.
- Probability and Statistics.
- Differential and integral calculus, Differential equations.
- Engineering Mathematics.

### **Graduates:**

- Mathematical Modeling.
- Mathematical Biology.
- Numerical Analysis.
- Differential Equations.

## **PREVIOUS EXPERIENCES**

### **A Research Experience**

Duration	Organisation	Area(s)
Feb 2005 – Jan 2007 (2 years), Post Doctoral Fellow.	Metapopulation Research Group University of Helsinki, Finland	Mathematical Biology, namely, Metapopulation Dynamics
Jan1996–Oct 1997 Senior Research Fellow (NET)	Department of Applied Mathematics, University of Calcutta, India.	Mathematical Biology, namely, Population Dynamics
Jan 1994–Dec 1995 Junior Research Fellow (NET)	Department of Applied Mathematics, University of Calcutta, India.	Mathematical Biology, namely, Population Dynamics.

### **B1 Teaching Experience**

Duration	Organisation	Area(s)
01.07.2008 – 22.10.2012 23.10.2012 till date	Assistant Professor. Associate Professor, Indian Institute of Technology, Roorkee	Both Pure and Applied Mathematics
10.03.2007 – 30.06.2008 (1 year 3.5 months)	Assistant Professor, Birla Institute of Technology and Science (BITS), Pilani, Rajasthan, India.	
01.09.2000 – 31.01.2005 (4 years 5 months)	Senior Lecturer, St. Xavier's College 30, Park Street, Kolkata- 700016, India	
03.10.1997 – 31.08.2000 (2 years 11 months)	Lecturer, Chittaranjan College, Beniatola Lane, Kolkata, India	

## **PUBLICATIONS (PAPERS)**

1. Teekam Singh and Sandip Banerjee, Spatiotemporal model of a predator-prey system with herd behavior and quadratic mortality, *International Journal of Bifurcation and Chaos* (Accepted).
2. Sumana Ghosh and Sandip Banerjee, Effects of antibodies and cytotoxic T-lymphocytes on cancer-a mathematical study, *International Journal of Applied and Computational Modeling* (Accepted).
3. Teekam Singh and Sandip Banerjee, Spatial aspect of hunting cooperation in predators with Holling type II functional response, *Journal of Biological Systems* (2018), 26(4), 511–531.
4. Subhas Khajanchi and Sandip Banerjee, Influence of multiple delays in brain tumor and immune system interaction with T11 target structure as a potent stimulator, *Mathematical Biosciences* 302 (2018), 116–130.
5. Sandip Banerjee and Ram Keval, Influence of Intracellular delay on the dynamics of Hepatitis C virus, *International Journal of Applied and Computational Modeling* (2018), 4:89. <https://doi.org/10.1007/s40819-018-0519-5>.
6. Sumana Ghosh and Sandip Banerjee, Mathematical modeling of cancer-immune system, considering the role of antibodies, *Theory in Biosciences* (2018), 137, 67–78.
7. Subhas Khajanchi and Sandip Banerjee, Role of constant prey refuge on stage structure predator-prey model with ratio dependent functional response, *Applied Mathematics and Computation* (2017), 314, 193–198.
8. Subhas Khajanchi and Sandip Banerjee, Quantifying the role of immunotherapeutic drug T11 target structure in progression of malignant gliomas: Mathematical modeling and dynamical perspective, *Mathematical Biosciences* 289 (2017), 69–77.
9. Sandip Banerjee, Ram Keval and Sunita Gakkhar, Global dynamics of Hepatitis C viral infection with logistic proliferation, *International Journal of Biomathematics* (February 16, 2016), 9 (4), 1– 25.
10. Sandip Banerjee, Subhas Khajanchi and Swapna Chowdhuri, Mathematical model to elucidate brain tumor abrogation by immunotherapy with T11 target structure, *PLoS ONE* (2015) 10(5), 1 – 21.

11. Sandip Banerjee and Alexei Tsygvintsev, Stability and bifurcations of equilibria in a delayed Kirschner–Panetta model , *Applied Mathematics Letters* (February 2015), 40, 65 – 71.
12. Subhas Khajanchi and Sandip Banerjee, Stability and bifurcation analysis of delay induced tumor immune interaction model, *Applied Mathematics and Computation*, (December 2014), 248, 652–671.
13. Alexei Tsygvintsev and Sandip Banerjee, Bounded immune response in immunotherapy described by delay Kirschner-Panetta model, *Applied Mathematics Letters* (May 2014), 35, 90 – 94.
14. A. Priyadarshi , Sandip Banerjee and S. Gakkhar, Geometry of the Poincaré compactification of a four-dimensional food-web system, *Applied Mathematics and Computation* (January 2014), 226, 229 – 237.
15. Sandip Banerjee, Ram Keval and Sunita Gakkhar, Modeling the dynamics of Hepatitis C Virus with combined antiviral drug therapy: Interferon and Ribavirin, *Mathematical Biosciences* (2013), 245, 235 – 248.
16. Shiferaw Feyissa and Sandip Banerjee, Delay-induced oscillatory dynamics in humoral mediated immune response with two time delays, *Nonlinear Analysis: Real World Applications* (2013), 14, 35 – 62.
17. Ram Keval, Sandip Banerjee and S. Gakkhar, Dynamics of Hepatitis C virus (HCV) infection with Gompertzian proliferation, *Procedia Engineering* (2012) 38, 2453 – 2462.
18. S. Gakkhar, A. Priyadarshi and Sandip Banerjee, Role of protection in a Tritrophic Food Chain Dynamics, *Journal of Biological Systems* (2012), 20(2), 155 – 175.
19. A. Priyadarshi, S. Gakkhar and Sandip Banerjee, Dynamics of density dependent closure term in a simple plankton model, *Communications in Computer and Information Sciences* (2012), 283(1), 193–200.
20. S. Gakkhar, A. Priyadarshi and Sandip Banerjee, Complex Behavior in Four Species Food-Web Model, *Journal of Biological Dynamics* (2012), 6 (2), 440 – 456.
21. A. Priyadarshi, S. Gakkhar and Sandip Banerjee, Role of Density Dependent Protection in a Food Chain System, *International Journal of Mathematical Sciences and Applications* (2012), 2(1), 425 – 433.

22. S. Gakkhar, A. Priyadarshi and Sandip Banerjee, Fluctuating Nutrient Input in a Simple Plankton System, *Journal of Nonlinear Systems and Application*, (2012), 3(1), 10 –21.
23. A. Priyadarshi, Sandip Banerjee and S. Gakkhar, Complex Dynamics of Plankton system with Hyperbolic and Sigmoidal Mortality of Zooplankton, *Review Bulletin of Calcutta Mathematical Society* (2011), 19(2), 225-236.
24. Sandip Banerjee, R. Bhattacharyya and B. Mukhopadhyay, A stage structure predator prey model with two discrete time delays, *Journal of Applied Mathematics and Informatics* (2010), 28 (5), 1 – 13.
25. Siddhartha P. Chakrabarty and Sandip Banerjee, A control theory approach to cancer self remission aided by an optimal therapy, *Journal of Biological Systems* (2010), 18(1), 75 – 91.
26. Sandip Banerjee, Immunotherapy with Interleukin – 2: a study based on mathematical modeling, *International Journal of Applied Mathematics and Computer Science* (2008), 18 (3), 1 – 10.
27. B. Dubey, Uma S. Dubey and Sandip Banerjee, Modeling the interaction between avascular cancerous cells and acquired immune response, *Journal of Biological Systems* (2008), 16 (3), 337 – 356.
28. Sandip Banerjee and Ram Rup Sarkar, Delay induced model for tumor-immune interaction and control of malignant tumor growth, *Biosystems* (2008), 91 (1), 268-288.
29. Ramrup Sarkar, R. Bhattacharyya, B. Mukhopadhyay and Sandip Banerjee, Time lags can control algal blooms in two harmful phytoplankton-zooplankton system, *Applied Mathematics and Computation* (2007), 186, 445 –459.
30. M. Banerjee and Sandip Banerjee, A stage structured prey-predator model with discrete time delay, *Applied Mathematics and Computation* (2006), 182 (2), 1385-1398.
31. Ramrup Sarkar and Sandip Banerjee, Cancer self remission and tumor stability – a stochastic approach, *Mathematical Biosciences* (2005), 196, 65–81.
32. R. Bhattacharya, M. Banerjee and Sandip Banerjee, Stability and Bifurcation in a Diffusive Prey-predator System: Non-linear Bifurcation Analysis, *Journal of Applied Mathematics and Computing* (2002), 10, 17–26.
33. Sandip Banerjee, Rakhi Bhattacharya and C. G. Chakrabarti, Shift of Bifurcation Point due to Noise Induced Parameter, *International Journal of Mathematics and Mathematical Sciences* (2000), 23 (6), 435– 439.

34. Sandip Banerjee, A Stochastic Model of a Diffusive Prey-Predator System: Fluctuation and Stability; *Journal of Natural and Physical Sciences* (2000), 14, 37–48.
35. Sandip Banerjee and C. G. Chakrabarti, Non-Linear Bifurcation Analysis of Reaction-Diffusion Activator-Inhibitor System, *Journal of Biological Physics* (1999), 25, 23–33.
36. Sandip Banerjee and C. G. Chakrabarti, Stochastic Dynamic Modeling of Damped Lotka-Volterra System, *System Analysis Modeling and Simulation* (1998) 30, 1–10.
37. Sandip Banerjee and C. G. Chakrabarti, Stochastic model of Symmetric Lotka-Volterra Competition System: Non-equilibrium Fluctuation and Stability, *Bulletin of Calcutta Mathematical Society* (1996), 88, 235–244.

### **PUBLICATION (CONFERENCE)**

1. Ram Reval and Sandip Banerjee (2017), Dynamics of Hepatitis C Viral Load with Optimal Control Treatment Strategy, In Rubem P Mondaini (Ed.), *Mathematical Biology and Biological Physics*, Proceedings of the International Symposium on Mathematical and Computational Biology (pp. 141-150), World Scientific Europe.
2. Sandip Banerjee (2015), Rich Dynamics of Hepatitis C viral Infection with logistic proliferation, In Rubem P Mondaini (Ed.), *BIOMAT 2014*, Proceedings of the International Symposium on Mathematical and Computational Biology (pp. 221-231), World Scientific Europe.
3. Subhas Khajanchi and Sandip Banerjee (2013), Global stability of a tumor immune interaction model, *Mathematical Sciences International Research Journal* 2 (2), ISSN 2278 – 8697.
4. Ram Keval, Sandip Banerjee and S. Gakkhar (2012), Effect of Proliferation terms in the Dynamics of Hepatitis C Virus, Proceedings of the International Conference on Mathematical Modeling and Applied Soft Computing (pp. 727-735), Coimbatore, Conference Proceeding ISBN number: 978-81-923752-1-2.
5. A. Priyadarshi, S. Gakkhar and Sandip Banerjee (2012), Complexity to order: Protection in a tri-trophic Food Chain Dynamics, Annual International conference on Computational Mathematics, Computational Geometry and Statistics (pp. 55-59), Singapore, ISSN: 2251-1911.

6. S. Gakkar, A. Priyadarshi and Sandip Banerjee (2011), A Numerical Study of a Simple Plankton System with Fluctuating Nutrient Input, Proceedings of The National Workshop-Cum-Conference on Recent Trends in Mathematics and Computing (pp. 165-169), Bhiwani, Conference Proceeding ISSN number: 819039523X.

7. Ram Rup Sarkar and Sandip Banerjee, A time delay model for control of malignant tumor growth, In M. Lakshmanan and R. Sahadevan (eds.), Nonlinear Phenomena in Medical and Biological Sciences, Proceedings of the Third National Conference on Nonlinear Systems and Dynamics (pp. 223-226), Allied Publishers Pvt. Ltd.

### **PUBLICATIONS (BOOKS)**

1. Mathematical Modeling: Models, Analysis and Applications (Feb 7 2014), CRC Press, Taylor and Francis Group.
2. Numerical Analysis and Computational Procedures (2006), Books and Allied Private Ltd, India.
3. Chapter in edited volumes: *Cancer self Remission and Tumor Instability as a prey predator System* in "Mathematical Biology - Recent Trends" , Editors Peeyush Chandra and B.V. Rathish Kumar, 2006., Anamaya Publications, pp 312 - 315, 2006.
4. Topics in Mathematics I: Numerical methods, Linear Programming, Probability and Statistics (2005), Books and Allied Private Ltd, India.

### **SUBMITTED PAPERS**

1. Shieferaw Feyissa and Sandip Banerjee, Bifurcation Analysis of a cancer model with antibody mediated immune responses.
2. Sumana Ghosh and Sandip Banerjee, Humoral and cell mediated responses on cancer immune system – a study based on mathematical modeling.
3. Sumana Ghosh and Sandip Banerjee, Combined effect of humoral and cell mediated immune system with Holling type II functional response
4. Sumana Ghosh and Sandip Banerjee, Mathematical model of cancer and cell mediated immune system with two discrete time delays, considering the role of antibodies
5. Teekam Singh and Sandip Banerjee, Spatiotemporal dynamics of malignant gliomas and immune system considering the role of immunotherapeutic agent T11 target structure (Computers and Mathematics with Application).
6. Rajat Kaushik and Sandip Banerjee, Mathematical model of a stage-structured predator-prey system: Bachelor herding impose ecological constraints on predation.

7. Subhas Khajanchi and Sandip Banerjee, A strategy of optimal efficacy of T11 target structure in the treatment of brain tumor (Journal of Biological Systems).
8. Teekam Singh and Sandip Banerjee, Spatiotemporal Dynamics of Immunogenic Tumors (Biophysical Reviews and Letters).
9. Rajat Kaushik and Sandip Banerjee, Predator-prey system: prey's defence passes into counter-attack against juvenile predators (Theoretical population Biology).

### **AWARDS AND HONORS**

1. Felicitated by Medal by Indo-US Technology Forum for his contribution in Indo-US Fellowship 2009 program at First Indo-US research Fellowship Conclave, Pune, 15-17 March 2013.
2. Indo-US Fellowship 2009. I have visited North Carolina State University, Raleigh to work with Prof. Hien Tran, Department of Mathematics for 3 months.
3. National Scholarship in the Bachelor of Sciences in 1991.

### **PROFESSIONAL MEMBERSHIP**

- |  |             |
|--|-------------|
| 1. SIAM membership                         | Yearly      |
| 2. Society for Mathematical Biology        | Yearly      |
| 3. Indian Statistical Institute            | Life member |
| 4. The Indian Science Congress Association | Life Member |

### **COLLABORATORS**

1. Dr. Ram Rup Sarkar, National Chemical Laboratory Pune.
2. Dr. Siddhartha P. Chakrabarti, IIT Guwahati.
3. Dr. Swapna Chaudhuri, School of Tropical Medicine, Kolkata.
4. Prof. Sunita Gakkhar, IIT Roorkee.
5. Dr. Alexei Tsygvintsev, University of Lyon, France.
6. Dr. Malay Banerjee, IIT Kanpur.
7. Prof. Hide Yamazaki, Department of Ocean Sciences, Tokyo University of Marine Science and Technology.

### **WORK IN PROGRESS**

1. (with Otso Ovaskainen) Existence of space and stochasticity on n-competing plant species.
2. (with Hide Yamazaki) Mathematical modeling of phytoplankton bloom through closure method.



## **REVIEWER**

1. Mathematical Reviews/MathSciNet Reviewer.
2. Journal of Theoretical Biology.
3. Chaos, Solitons & Fractals.
4. Applied Mathematics and Computation.
5. Biosystems.
6. SIAM Journal of Applied Mathematics.

## **ORGANIZATION OF WORKSHOPS/CONFERENCES/SEMINARS**

- Convener of the workshop titled Micro-scale variability and planktonic ecosystem models on January 20, 2017 in the Department of Mathematics, IIT Roorkee in association with Department of Ocean Sciences, Tokyo University of Marine Science and Technology.
- Convener of the workshop titled MATHEMATICA as a teaching aid under Technical Education Quality Improvement Programme (TEQIP) from March 10–12, 2016 in the Department of Mathematics, IIT Roorkee.
- Chairman and Convener of BIOMAT 2015, International Symposium on Mathematical and Computational Biology from November 2–6, 2015 in the Department of Mathematics, IIT Roorkee.
- Convener of Indo-Canadian Workshop on the Mathematical Modeling of Infectious Diseases from January 20–22, 2014 in the Department of Mathematics, IIT Roorkee.

## **INVOLVEMENT IN COURSE DEVELOPMENT**

- Course developer (Numerical Analysis) in National Program on Technology enhanced learning (NPTEL phase II).
- Course developer (Differential equations and Special functions) in e-PG pathshala, an MHRD project.

## SPONSORED PROJECTS

Period	Sponsoring Organization	Title of Project	Amount of Grant	Co-Investigators (if any)
3 years 2018-	Science and Engineering Research Board (SERB)	Mathematical modeling of Phytoplankton dynamics with highly irregular distribution.	Rs. 19,032,00.00	
(2 years) April 1 2015 - 31st March 2017.	Indo French Center for Applied Mathematics	Mathematical Models in Biology: Dynamics Systems Approach.	Euro 12444 approved for two years.	Alexei Tsygvintsev, Unit of Pure and Applied Mathematics, Lyon, France. (Completed)
(1 year) April 1 2014 - 31st March 2015.	Indo French Center for Applied Mathematics	Mathematical Modeling of Tumor-Immune Interaction considering the role of antibodies.	Euro 5022	Alexei Tsygvintsev, Unit of Pure and Applied Mathematics, Lyon, France. (Completed)
1 year Jan1 2013 - Dec 31st 2013	Indo French Center for Applied Mathematics	Theoretical and numerical study of Kirschner-Panetta equations in immunotherapy of cancer.	Euro 5800	Alexei Tsygvintsev, Unit of Pure and Applied Mathematics, Lyon, France. (Completed)
3 years (October 11 - March 15)	DST	Mathematical Modeling of Malignant Brain Tumor with T11 Target Structure as a Potent Immune Stimulator	Rs. 21,39,360.00	Dr. Swapna Chaudhuri Professor and Head , Department of Laboratory Medicine, School of Tropical Medicine, Kolkata. (Completed)
23.10.08 to 22.10.11 (3 years)	IIT Roorkee	Optimally controlled treatment strategy using Interferon and Ribavirin for Hepatitis C Virus.	Rs. 3,21,900.00	Completed

## PH. D. GUIDANCE

Year	No. of Students in Hand	No. of Students Registered	No. of Ph. Ds Completed	Placement of the student
2008-2009	03	03	00	NA
2009-2010	03	03	00	NA
2010-2011	03	03	00	NA
2011-2012	02+01	03	01 <b>Thesis title:</b> Role of Antibodies: A Paradigm in Mathematical Modeling for Cancer Treatment.	Shiferaw F. Balcha, Dean, Adama Science and Technology University, Ethiopia.
2012-2013	02+02	04	01 <b>Thesis title:</b> Complex Behavior in Four Species Food-Web Model. (jointly with Prof. Sunita Gakkhar)	Anupam Priyadarshi, Assistant Professor, Department of Mathematics, Benaras Hindu University.
2013-2014	04	04	00	NA
2014-2015	03	03	01 <b>Thesis title:</b> Mathematical Modeling of Hepatitis C Viral Kinetics (jointly with Prof. Sunita Gakkhar)	Ram Keval Department of Applied Sciences Madan Mohan Malaviya University of Technology, Gorakhpur, Uttar Pradesh.
2015-2016	04	04	01 <b>Thesis title:</b> Mathematical Modeling of Malignant Brain Tumor with T11 Target Structure	Subhas Khajanchi Department of Mathematics, Presidency University, Kolkata.
2017-2018	02	02	02 <b>Thesis title:</b> Mathematical models of humoral and cell mediated immune responses – a comparative study.	Sumana Ghosh Post-doctoral fellow under Dr. Samrat Chatterjee, Drug Discovery Research Centre, Faridabad, Haryana.
			<b>Thesis title:</b> Spatial aspects of some tumor-immune and ecological models.	Teekam Singh

## **SEMINARS / WORKSHOPS / TALKS**

1. Resource Person for IFCAM (Indo French Center for Applied Mathematics) Summer School on Mathematical and Computational Biology organized by Indian Institute of Science, Bangalore (July 19 – 20, 2018).
2. Mini-Symposium speaker, talk titled A strategy of optimal efficacy of T11 target structure in the treatment of brain tumor at The 12th AIMS Conference on Dynamical Systems, Differential Equations and Applications, Taipei, Taiwan (July 5 - July 9, 2018).
3. Invited talk at National Seminar on Mathematics and Applications - 2018 (NSMA-2018), organized by Department of Mathematics, University of Kalyani (Feb 22-23, 2018).
4. Keynote speaker at National Training Programme on The Art of Mathematical Modeling as Teaching Pedagogy, organized by St. Aloysius College (Autonomous), Jabalpur (Feb 9-10, 2018).
5. Keynote speaker, talk titled Mathematical Modeling of Cancer Immune system with Humoral and Cell Mediated Immune Responses at BIOMAT 2017, Institute of Numerical Mathematics, Russian Academy of Sciences, Moscow, Russia (October 30 - November 3, 2017).
6. Resource Person for Hands-on workshop on public health analytics and disease modeling at Dept. of Anthropology, NEHU, Shillong, Meghalaya, organized by Indian Statistical Institute, Kolkata (May 02 – 05, 2017).
7. Visited Unit of Pure and Applied Mathematics, Lyon (ENS Lyon), France for scientific collaboration with Dr. Alexei Tsygvintsev, under the project titled Mathematical Models in Biology: Dynamics Systems Approach funded by Indo French Center for Applied Mathematics (IFCAM) (22<sup>nd</sup> March-29<sup>th</sup> March, 2017).
8. Resource Person for the workshop titled Advances in Stability Analysis on Dynamical Systems under TEQIP II from 8th March, 2017 to 12th March, 2017 at the Department of Mathematics, NIT Silchar Assam.
9. Invited talk titled Sensitivity Analysis and Parameter Estimation in a Brain Tumor Model at Recent Advances in Computational Mathematics, Department of Applied Mathematics, University of Calcutta (December 27 - 29, 2016).
10. Visited Department of Ocean Sciences, Tokyo University of Marine Science and Technology for scientific collaboration with Prof. Hide Yamazaki on Phytoplankton ( December 3 - 13, 2016).
11. Keynote speaker, talk titled Sensitivity Analysis and Parameter Estimation in a Brain Tumor Model at BIOMAT 2016, Chern Institute of Mathematics, Nankai University, Tianjin, China (October 30 - November 5, 2016).

12. Invited talk titled Mathematical model to elucidate brain tumor abrogation by immunotherapy with T11 target structure at Indo-UK initiative in Applied Mathematics workshop on Mathematics and Statistics of Biological Populations at Chail, organized by Prof. Somdatta Sinha, IISER Mohali (May 23-May 28, 2016).
13. Invited talk titled Influence of Intracellular Delay on the Dynamics of Hepatitis C Virus at Advances in Mathematical and Computational Biology, IIT Ropar, India (May 21 – May 22, 2016).
14. Mini-Symposium speaker, talk titled Mathematical Modeling of Malignant Brain Tumor with Immunostimulatory glycoprotein T11 target structure at International Congress of Industrial and Applied Mathematics (ICIAM 2015), Beijing, China (August 10 – August 14, 2015).
15. Invited Talk titled Mathematical model to elucidate brain tumor abrogation by immunotherapy with T11 target structure at International Conference on Mathematical and Computational Biology, IIT Kanpur, India (February 28-March 3, 2015).
16. Invited talk titled Rich Dynamics of Hepatitis C viral infection with logistic proliferation at BIOMAT 2014, Stefan Banach International Mathematical Centre, Institute of Mathematics, Polish Academy of Sciences, Bedlewo near Poznan, Poland (November 2-8, 2014).
17. Talk titled Mathematical Modeling of Malignant Brain Tumor with T11 Target Structure as a Potent Immune Stimulator at SIAM Conference on Life Sciences (LS14), Charlotte, North Carolina, USA (August 4-7, 2014).
18. Visited Unit of Pure and Applied Mathematics, Lyon (ENS Lyon), France for scientific collaboration with Dr. Alexei Tsygvintsev, under the project titled Mathematical Modeling of Tumor-Immune Interaction considering the role of antibodies funded by Indo French Center for Applied Mathematics (IFCAM) (3rd June - 17th June, 2014).
19. Mini-Symposium speaker, talk titled Parameter Estimation and Sensitivity Analysis of a Mathematical Model of a Tumor Immune System considering the Role of Antibodies at Applied Inverse Problem Conference organized by Korea Advanced Institute for Sciences and technology, Daejeon, Korea (July 1<sup>st</sup> - 5<sup>th</sup> , 2013).
20. Invited talk titled Influence of Intracellular Delay on the Dynamics of Hepatitis C Virus at University Pierre and Marie Curie, Institute of Mathematics, Paris, France (June 14th, 2013).
21. Visited Unit of Pure and Applied Mathematics, Lyon (ENS Lyon), France for scientific collaboration with Dr. Alexei Tsygvintsev, under the project titled Theoretical and numerical study of Kirschner-Panetta equations in immunotherapy of cancer funded by Indo French Center for Applied Mathematics (IFCAM) (2nd June - 21st June, 2013).

22. Invited talk titled Modeling the dynamics of Hepatitis C Virus with combined antiviral drug therapy: Interferon and Ribavirin at National Seminar on the Recent Trends in Mathematics organised by University of Kalyani, West Bengal (7-8 March, 2013).
23. Invited talk titled Dynamics of Hepatitis C virus (HCV) infection with Gompertzian proliferation at the workshop organized by Indo-French Centre for Applied Mathematics, Nice, France (November 19 - 21, 2012).
24. Keynote speaker, talk titled Global Stability of Mathematical Model of Hepatitis C Virus at the National Conference on Modeling, Computational Fluid Dynamics and Operation Research organized by BITS Pilani (February 4<sup>th</sup> – 5<sup>th</sup>, 2012).
25. Mini-Symposium speaker, talk titled Model Development, Parameter estimation and Validation at International Conference on Theoretical and Mathematical Biology jointly organized by The Society for Mathematical Biology, IISER Pune and Center for Mathematical Biology at IISER Pune (January 23<sup>rd</sup> – 27<sup>th</sup>, 2012).
26. Invited talk at Recent Advances in Industrial and Applied Mathematics, organized by IIT Bombay in Collaboration with the Department of Mathematics at University of Birmingham, UK (November 4<sup>th</sup> -6<sup>th</sup>, 2011).
27. Talk titled Rich Dynamics of Hepatitis C viral infection with logistic proliferation at the conference Mathematical and Theoretical Ecology 2011: Linking models with ecological processes organized by University of Essex, UK (September 19<sup>th</sup> – 21<sup>st</sup>, 2011).
28. Invited talk at International Conference on Mathematical Biology jointly organized jointly by DST Centre for Mathematical Biology and Indian Institute of Science, Bangalore (July 4<sup>th</sup> – July 7<sup>th</sup>, 2011).
29. Resource person at Study Group Meeting on Industrial Problems (SGMIP – 2011), organized by Supercomputer Education and Research Centre (SERC), Indian Institute of Science (IISc), Bangalore and Industrial Mathematics Group (IMG), Indian Institute of Technology Bombay (IIT B), in collaboration with Oxford Centre for Collaborative Applied Mathematics (OCCAM), University of Oxford, United Kingdom (March 14-19, 2011).
30. Invited talk at National Conference on Theoretical Biology and Biomathematics (NCTBB 2010) organized jointly by Centre for Mathematical Biology and Ecology, Department of Mathematics, Jadavpur University, Kolkata and Biomathematical Society of India (15-16<sup>th</sup> December, 2010).
31. Invited talk at Symposium on Mathematical Ecology organized jointly by Indian Institute of Science Education and Research (IISER-Kolkata) and DST Centre for Mathematical Biology (13-14<sup>th</sup> December, 2010).
32. Invited talk at International Conference on recent development in Mathematical Sciences and their Applications (ICRDMSA 2010) organized by Calcutta Mathematical Society (11<sup>th</sup> December, 2010).

33. Resource person at Workshop on Mathematical Ecology organized jointly by Indian Institute of Science Education and Research (IISER-Kolkata) and DST Centre for Mathematical Biology (10<sup>th</sup> December, 2010).
34. Invited talk at National Seminar titled Differential Equations and Mathematical Modeling, organized by Mathematics Department, Lady Shri Ram College for Women, University of Delhi (September 9<sup>th</sup> , 2010).
35. Invited talk at Laboratory of Applied Mathematics, University of Pau and Pays de l'Adour, Lyon, France (3<sup>rd</sup> March, 2010).
36. Invited talk at Unit of Pure and Applied Mathematics, Lyon, France (March 1<sup>st</sup> 2010).
37. Invited talk at Symposium on Theoretical and Mathematical Biology organized by IISER Pune, CCMB Hyderabad and NCL Pune (October 10-11, 2009).
38. Invited talk at National Conference on Mathematical Modeling and Simulation jointly by Jiwaji University, Gwalior and ABV-Indian Institute of Information Technology & Management, Gwalior (January 9 – 11, 2009).
39. Invited talk at Department of Mathematics, IIT Guwahati, India (March 13, 2008).
40. International Biomedical Modeling School and Workshop, organized by the Centre for Applicable Mathematics, TIFR, Bangalore, India (Feb 27 – Mar 02, 2008).
41. Talk titled “*Delay induced model for tumor-immune interaction and control of malignant tumor growth*” at Indian Institute of Technology, Kanpur, India (24<sup>th</sup> August, 2007).
42. Refresher Course on “*Advances in Biophysics*”, Centre of Cellular and molecular Biology, Hyderabad, India (25<sup>th</sup> May – June 8<sup>th</sup> , 2007).
43. Talk titled “*A time delay model for malignant tumor growth*” at Tata Institute of Fundamental Research (TIFR), Bangalore, India (21<sup>st</sup> November, 2006).
44. Talk titled “*Spatial Ecology*” at the Department of Civil Engineering, University of Glasgow, Scotland, UK (18th September, 2006).
45. Talk titled “*Modeling tumor-immune interactions and control of malignant tumor growth - a study based on time delay effect*” at the Faculty of Veterinary Medicine, University of Glasgow, Scotland, UK (11th September, 2006).
46. Talk titled “*Modeling tumor-immune interactions and control of malignant tumor growth - a study based on time delay effect*” at the Department of Mathematics, University of Dundee, Scotland, UK (30th August, 2006).

47. *SIAM Conference on the Life Sciences* (July 31-August 4, 06), Brownstone Hotel and Conference Center 1707 Hillsborough Street Raleigh, North Carolina, to present a paper.
48. *CM06 Workshop III: Angiogenesis, NeoVascularization and Morphogenesis* (May 8-12, 2006) organized by Institute for Pure and Applied Mathematics (IPAM) situated on the University of California, Los Angeles campus.
49. Workshop on Spatial Ecology (March 13-17, 2006) organized by Lou Gross, Claudia Neuhauser, Chris Cosner, and Mark Kot, Mathematical Biosciences Institute (MBI), Ohio State University.
50. Talk at the Department of Applied Mathematics, University of Leeds (16th January, 2006) on "Effect of delay on malignant tumor".
51. Workshop entitled "Mathematical Modeling in Medicine" organized by Prof. Brian Sleeman, Department of Applied Mathematics, University of Leeds.
52. Workshop on Mathematical Biology (19th December, 2005), organized by Biomathematics Research Group, spearheaded by Prof. Mats Gyllenberg, Department of Mathematics, University of Helsinki.
53. International Seminar on Mathematical Biology (February, 2004) organized by Prof. Piyush Chandra, Head, Department of Mathematics, Indian Institute of Technology, Kanpur, India.
54. Talk (February 2002) entitled "Non-Linear bifurcation Analysis of Reaction-Diffusion Activator-Inhibitor System" at the Biomathematical Research Group, University of Turku, Finland.