

MEMORANDUM OF UNDERSTANDING

Between

National Institute of Immunology

Aruna Asaf Ali Marg, Jawaharlal Nehru University, New Delhi, Delhi 110067

AND

Center for Systems Biology and Molecular Medicine

**Yenepoya Research Center, Yenepoya (Deemed to be University), Deralakatte, Mangalore-
575 018, Karnataka, India.**

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19/12

Registrar
Yenepoya (Deemed to be University)
University Road, Deralakatte
Mangalore 575 018

ATTESTED

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1
Dr. Gangadhara Somayaji K S
Registrar
Yenepoya (Deemed to be University)
University Road, Deralakatte
Mangalore 575 018, Karnataka.

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19/12/2020



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MEMORANDUM OF UNDERSTANDING

THIS MEMORANDUM OF UNDERSTANDING made and entered on this 8th day of February Two Thousand Twenty between

CENTER FOR SYSTEMS BIOLOGY AND MOLECULAR MEDICINE, Yenepoya Research Center, Yenepoya (Deemed to be University), Deralakatte, Mangalore 575 018, Karnataka, India (hereinafter called 'CSBMM').

Dr. Jangadhara Somayaji
19/2

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Dr. Jangadhara Somayaji

Statutory Alert:

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Registrar

Yenepoya Deemed to be University
University Road, Deralakatte
Mangalore 575 018

Dr. Jangadhara Somayaji K S
Registrar
Yenepoya (Deemed to be University)
University Road, Deralakatte
Mangalore 575 018, Karnataka

AND

NATIONAL INSTITUTE OF IMMUNOLOGY, an autonomous Indian research Institute registered as an autonomous society under the Societies Registration Act (XXI of 1860) and supported by the Department of Biotechnology, Government of India, having its registered office at Aruna Asaf Ali Marg, New Delhi 110 067 (hereinafter called 'NII').

WHEREAS CSBMM is an academic research center at Yenepoya (Deemed to be University), which is being administered through Yenepoya Research Center, engaged in the genomic, proteomic and metabolomic approaches to investigate biological systems including model organisms such as yeast, worm, fly, mouse to human.

Whereas the NII being a premier Institute engaged in advanced research activities with a view to understand body's defense mechanisms for developing modalities of immune system manipulation that can intervene with disease processes.

Whereas this MoU pertains to Dr. Pushkar Sharma's laboratory (EGE-NII) who is interested in dissection of signaling pathways in apicomplexan parasites (*Plasmodium falciparum* and *Toxoplasma gondii*) and mammalian neurons.

Both the above parties held discussions at various times to enter into an agreement related to matters of mutual interest and decided to deduce their respective roles and points of agreement jointly hereunder:

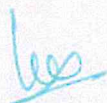
The following are the conditions of the MOU

1. Dr. Keshava Prasad's (KP) team from CSBMM has discussed several potential collaborative projects with the team of Dr. Pushkar Sharma (PS) from NII over the period of last six months. Both the parties decided to work closely on research projects pertaining to OMICs-based discovery of altered signaling networks and metabolites in determining and deciphering new biological phenomenon with respect to two different areas – malaria biology and neuronal signaling. These research projects will be an attempt to enhance the knowledge in the field of molecular dynamics and signaling pathways in these two areas.

3 **Dr. Gangadhara Somayaji K S**
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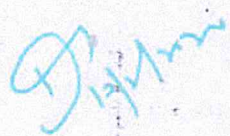
2. Dr. Keshava Prasad and other scientists assigned by the Centre will represent the CSBMM and Dr. Pushkar Sharma and other scientists will represent NII. KP and PS will co-ordinate and supervise the above-mentioned research projects.
3. Both the parties will work for academic interest. In the event of the outcome of any intellectual property, both the institutes will share it as and then decided upon. All participants from both organizations (*as specified by the representatives of both centers*) will be co-authors in research papers, conference presentations and academic events that emanate from the proposed research projects.
4. Both parties agree that any Confidential Information that may arise as a direct result of this MoU will not be disclosed in any form without the written approval of the other party. In this context, confidential information means any information that is generally not known to the public or scientific community whether in tangible or intangible form. This non-disclosure agreement is applicable to all members from both the institutions.
5. As per the mutual agreement, following Scientific Review Board and Ethics Board approval relevant to selected research projects, wherever applicable, NII will facilitate and extend; expertise, consultations, and specimens for analysis as appropriate.
6. NII will bear all the logistics, consumables for sample collection, storage and subsequent transport of biological samples on their own funds. Sample preparation and mass spectrometry will be carried out by CSBMM to generate data.
7. NII and CSBMM will bear the basic cost of mass spectrometry run and data analysis from their own research funds.
8. CSBMM will provide the instrumentation time on priority, expertise in sample preparation, mass spectrometry, genomics, transcriptomics, metabolomic, bioinformatics data analysis and data interpretation using commercial software available.
9. Faculties, Master's, Research Associates, Post-doctoral Fellows and Ph.D. students of NII and CSBMM working on specific projects would be hosted at each other's laboratory for projects and training. Hostel facility for students would be extended for a reasonable fee subject to availability.
10. NII and CSBMM scientists will develop joint grant proposals and put efforts to get joint research grants.
11. This study will not involve any type of radioactive material.


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12. The tenure of this MOU will be for 3 years from the date of signing, after which it may be renewed after approval of competent authorities or authorized signatories of both the parties.
13. Any articles of the MOU may be modified or changed by mutual agreement of the parties hereto in writing. The modifications and changes shall be effective from the date on which they are made unless otherwise agreed to.
14. All disagreements, difference of opinion, disputes regarding the interpretation of the provision of this MOU shall be resolved by mutual consultation of the heads of the institute or their authorized representatives. In the event, this does not resolve the issue, an external expert may be appointed as Arbitrator. Such an external expert shall be appointed with the approval of the Heads of both the institutions.

<p>Signature: <i>[Handwritten Signature]</i> Date: <i>19/02/2020</i></p> <p>Dr. Gangadhar Somayaji Registrar Yenepoya (Deemed to be University), Mangalore - 575018, Karnataka, India</p> <p><i>Ypn Registrar</i> Yenepoya (Deemed to be University) University Road, Deralakatte Mangalore 575 018</p>	<p>Signature: <i>[Handwritten Signature]</i> Date:</p> <p>Lt Col (Dr.) D K Vashist Senior Manager National Institute of Immunology, Aruna Asaf Ali Marg, Jawaharlal Nehru University, New Delhi-110067</p> <p><i>Lt. Col. (Dr.) D K Vashist</i> Senior Manager (Head of Administration) राष्ट्रीय प्रतिरक्षाविज्ञान संस्थान National Institute of Immunology अरुणा आसफ अली मार्ग / Aruna Asaf Ali Marg नई दिल्ली-110 067 / New Delhi - 110 067</p>
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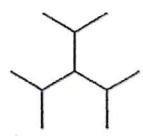
Witness: *Prachant Modi*
Dr. Prachant Kumar Modi

Witness: *Dr. Anil Kumar*

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Registrar
Yenepoya (Deemed to be University)
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3.7.1. 19-20 I



NATIONAL INSTITUTE OF IMMUNOLOGY

Pushkar Sharma, Ph.D.
Scientist

Email: pushkar@nii.res.in
Tel: +91-11-26717123 ext 491
Fax: +91-11-26162125

To,

The Registrar,
Yenepoya University, Mangalore

Subject: Attendance Certificate- Prof. Keshava Prasad, at NII, Delhi of June 20.

Dear Sir,

This is to certify that Prof. T. S. Keshava Prasad and I discussed the progress of our COE grant National Institute of Immunology (NII), New Delhi on June 20, 2017. In addition, we discussed potential collaborative research proposals.

It was a very productive meeting. I personally thank you for enabling Dr. Prasad to attend this joint meeting.

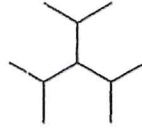
Thanks,

Dr. Pushkar Sharma

21.6.2018

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Dr. Gangadhara Somayaji K S
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University Road, Devalakatte
Mangalore 575 018, Karnataka



NATIONAL INSTITUTE OF IMMUNOLOGY

Pushkar Sharma, Ph.D.

Scientist

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Fax: +91-11-2674125

Prof. Keshava Prasad
Centre for Systems Biology
and Molecular Medicine
Yenepoya University
Mangalore

12.2.2020

Dear Keshav,

As discussed with you earlier, Ms. Neelam Antil is now trained in sample preparation for phosphoproteomics. Now, she is ready with several sets of samples for the analysis of phosphoproteome and interactome. I would like her to visit CSBMM to analyze these samples at CSBMM under your supervision. She can also carry out subsequent data analysis of these samples there. She can also contribute to writing our joint-manuscripts as well as future-grants.

Forwarded for permission.
[Signature]

Best Wishes

Pushkar Sharma
Staff Scientist VII

From - To.

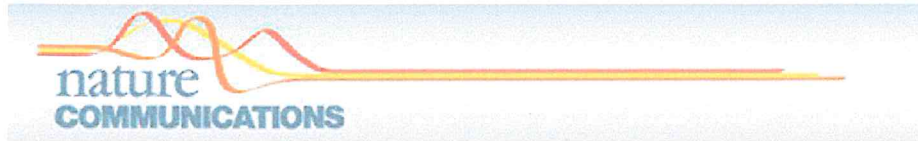
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17/2/2020

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[Nat Commun.](#) 2017; 8: 63.

PMCID: PMC5498596

Published online 2017 Jul 5. doi: [10.1038/s41467-017-00053-1](https://doi.org/10.1038/s41467-017-00053-1)

PMID: [28680058](https://pubmed.ncbi.nlm.nih.gov/28680058/)

PfCDPK1 mediated signaling in erythrocytic stages of *Plasmodium falciparum*

[Sudhir Kumar](#),^{#1} [Manish Kumar](#),^{#2,3} [Roseleen Ekka](#),¹ [Jeffrey D. Dvorin](#),^{4,5} [Aditya S. Paul](#),⁴
[Anil K. Madugundu](#),^{2,6} [Tim Gilberger](#),⁷ [Harsha Gowda](#),^{2,8} [Manoj T. Duraisingh](#),⁴ [T. S. Keshava Prasad](#),^{2,8,9} and
[Pushkar Sharma](#)^{✉1}

¹Eukaryotic Gene Expression laboratory, National Institute of Immunology, New Delhi, 110067 India

²Institute of Bioinformatics, Bangalore, Karnataka 560066 India

³Manipal University, Madhav Nagar, Manipal, Karnataka 576104 India

⁴Harvard TH Chan School of Public Health, Harvard University, Boston, Massachusetts 02115 USA

⁵Boston Children's Hospital and Harvard Medical School, Boston, Massachusetts 02115 USA

⁶Centre for Bioinformatics, Pondicherry University, Puducherry, 605014 India

⁷Bernhard Nocht Institute for Tropical Medicine and Centre for Structural Systems Biology, Hamburg, 20359 Germany

⁸YU-IOB Center for Systems Biology and Molecular Medicine, Yenepoya University, Mangalore, 575018 India

⁹Proteomics and Bioinformatics Laboratory, Neurobiology Research Centre, National Institute of Mental Health and Neuro Sciences, Bangalore, Karnataka 560029 India

Pushkar Sharma, Email: pushkar@nii.ac.in.

✉ Corresponding author.

#Contributed equally.

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Abstract

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Dr. Gangadhara Somayaji K S
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Mangalore 575 018, Karnataka.

K-tech



YENEPOYA
(DEEMED TO BE UNIVERSITY)
Recognised under Sec 3(A) of the UGC Act 1956
Accredited by NAAC with 'A' Grade



Center for Systems Biology and Molecular Medicine

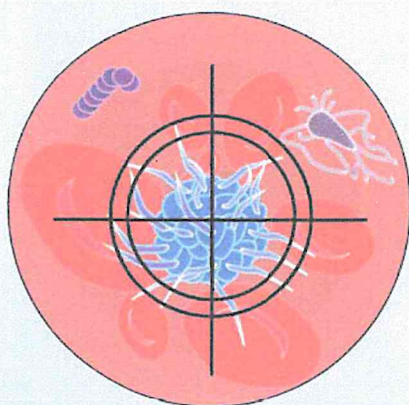
Yenepoya Research Centre, Mangalore

Invites you to

***International Symposium on
Discovery of Actionable
Targets in Infectious Diseases***

on 26th November, 2019

Venue: 5th Floor Auditorium
Yenepoya Dental College
Deralakatte, Mangalore-575018



Chief Guest

Dr. Anita Mahadevan

Professor, Neuropathology

**National Institute of Mental Health and Neuro Sciences,
Bangalore**

Mr. Yenepoya Abdullah Kunhi

Chancellor, Yenepoya (Deemed to be University)

will Preside

Dr. M. Vijayakumar

Vice Chancellor

Convenor

Dr. C. V. Raghuvier

Pro-Vice Chancellor

Dr. K.S. Gangadhara

Somayaji

Registrar

Dr. Rekha P.D.

Deputy Director, YRC

Co-Convenor

Dr. T. S. Keshava Prasad

Professor, CSBMM

Organizing Secretary

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University Road, Deralakatte
Mangalore 575 018, Karnataka.

Programme Schedule		
Plenary Lecture	Dr. Anita Mahadevan	09:15 AM- 10:00 AM
Scientific Talk	Prof. Trude Helen Flo	10:00 AM- 10:30 AM
Inauguration: 10:30 AM-11:05 AM		
Invocation		10:30 AM
Welcome Address	Dr. C. V. Raghuveer	10:33 AM
About the Symposium	Dr. T. S. Keshava Prasad	10:37 AM
Lighting of the lamp		10:42 AM
Address by the Chief Guest	Dr. Anita Mahadevan	10:45 AM
Address by the Vice Chancellor	Dr. M. Vijayakumar	10:50 AM
Presidential Address	Mr. Yenepoya Abdullah Kunhi	10:55 AM
Vote of Thanks	Dr. Rekha P.D.	10:59 AM
Scientific Sessions: 11:45 AM- 12:50 PM; 2:30 PM- 4:45 PM		
Speakers		
<u>Dr. Pushkar Sharma</u>	Dr. Maria Lerm	Dr. Amith Singh
Dr. Norbert Reiling	Dr. E. Pradeep Bulagonda	Anupam J Das
Valedictory: 4:45-5:15 PM		
Organizing Committee		
Dr. Pushkar Sharma, NII, New Delhi Dr. Anurag Bhargava, Yenepoya (Deemed to be University) Dr. Adhikari Prabha M.R., Yenepoya (Deemed to be University) Dr. Arun A. B., Yenepoya (Deemed to be University) Dr. Prashant Modi, Yenepoya (Deemed to be University) Dr. Yashodhar P. Bhandary, Yenepoya (Deemed to be University) Dr. Sudheer Shenoy P., Yenepoya (Deemed to be University) Dr. Shankar Prasad Das, Yenepoya (Deemed to be University) Dr. Raghu Bhushan, Yenepoya (Deemed to be University) Dr. Shobha D, Yenepoya (Deemed to be University) Dr. Bhagya N, Yenepoya (Deemed to be University) Dr. Suparna Laha, Yenepoya (Deemed to be University)		

**For Registration: csbmm.yenepoya.edu.in/workshop/symposium_19/
Email: csbmm@yenepoya.edu.in Phone: 0824-2204668 (Ext:2057)**

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Dr. Gangadhara Somayaji K S
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Mangalore 575 018, Karnataka.

International Symposium on Discovery of Actionable Targets in Infectious Diseases

November 26, 2019

Conducted by

Yenepoya (Deemed to be University), Mangalore

under the aegis of

Olav Thon Foundation grant and BiSEP program, K-Tech, Government of Karnataka

Scientific Program Schedule

09.15 AM – 10.00 AM	Plenary lecture <i>Challenges in dealing with Neuroinfections</i> Dr. Anita Mahadevan , Professor, Neuropathology, National Institute of Mental Health and Neuro Sciences, Bangalore
10.00 AM – 10.30 AM	Scientific Talk <i>Plasma membrane damage by Mycobacterium tuberculosis induce inflammasome activation and pyroptosis in host macrophages</i> Prof. Trude Helen Flo , Professor in Cell Biology and Co-director, Centre of Molecular Inflammation Research, Norwegian University of Science and Technology, Trondheim, Norway
10.30 AM – 11.05 AM	Inauguration
11.10 AM – 11.45 AM	High Tea

Scientific Session 1

11.45 AM – 12.15 PM	<i>Signaling networks in apicomplexan parasites</i> Dr. Pushkar Sharma , Senior Scientist, National Institute of Immunology, New Delhi
12.20 PM – 12.50 PM	<i>Host lipid metabolism as adjunctive treatment target in tuberculosis</i> PD Dr. Norbert Reiling , Head, Microbial Interface Biology, Research Center Borstel, Leibniz Pulmonary Center, Germany
Session chair	Dr. Prabha Adhikari , Professor, General Medicine, Yenepoya Medical College, Yenepoya (Deemed to be University), Mangalore
Moderator	Prashant Kumar Modi, Ph.D.
1:00 PM -2:30 PM	Lunch and Poster session

Scientific Session 2

2.30 PM – 3.00 PM	<i>Redox-based Drug tolerance in Mycobacterium tuberculosis</i>
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Dr. Gangadhara Somayaji KS
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Yenepoya (Deemed to be University)
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Mangalore 575 018, Karnataka

	Dr. Amith Singh , Associate Professor, Department of Microbiology and Cell Biology, Indian Institute of Science, Bangalore
3:00 PM - 3:30 PM	<i>Searching for more effective TB treatment: a drug targeting tuberculosis bacteria, that hide inside cells</i> Dr. Maria Lerm, Professor, Department of Clinical and Experimental Medicine (IKE), Division of Microbiology, Infection and Inflammation (MII), Linköping University, Sweden
Session chair Moderator	Dr. Vidya Pai, Professor, Microbiology, Yenepoya Medical College, Yenepoya Yenepoya (Deemed to be University), Mangalore Shobha Dagamajalu, Ph.D.
3:30 PM – 3:45 PM	Tea Break

Scientific Session 3

3:45 PM - 4:15 PM	<i>Comparative Genomics of Clinically relevant pathogens</i> Dr. E. Pradeep Bulagonda, Assistant Professor, Department of Biosciences, Sri Sathya Sai Institute of Higher Learning, Prasanthi Nilayam
4:15 PM - 4:45 PM	<i>Futuristic Trends in Genomics transforming medicine</i> Anupam J Das, CEO, MolSys Scientific Pvt Ltd, Bangalore
Session chair Moderator	Shankar Prasad Das, Ph.D., Assistant Professor, Yenepoya Research Centre, Yenepoya (Deemed to be University), Mangalore Suparna Laha, Ph.D.
4:45 PM - 5:15 PM	Announcement of Results of poster presentation Feedback by the participants Valedictory


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Mangalore 575 018, Karnataka.

Team Science Grants Application Form

1. Team composition and management

Note: This section should include information on PI and co-PIs. If you want to add more investigators on the project, please add their information in the given format.

Q1. Please provide composition of the team that is applying for this grant.

Principal Investigator[PI]	
Full Name: (Title, Forename, Surname)	Pushkar Sharma
Discipline/expertise:	Signaling, protein kinases, <i>P. falciparum</i> asexual stage development Reverse and forward genetics, Cell biology and biochemistry, kinase inhibitor screening
Institution: (Include name of the organisation, department, address, city, country, pin code).	Eukaryotic Gene Expression Laboratory, National Institute of Immunology, New Delhi, 110067 India
Role:	1. Carrying out most research on asexual stages of malaria parasite, which includes reverse and forward genetics, cell biology, biochemistry. 2. Identification of kinase inhibitors that block parasite life cycle in blood stages of <i>P.falciparum</i> .

Co-Principal Investigator (1) [Co-PI(1)]	
Full Name: (Title, Forename, Surname)	T.S. Keshava Prasad
Discipline/expertise:	Proteomics, Phosphoproteomics, signaling pathways, Biological databases, Multiomics data analysis, metabolomics All abovementioned technologies in the context of infectious diseases, neurological disorder and cancers
Institution: (Include name of the organisation, department, address, city, country, pin code).	Center for Systems Biology and Molecular Medicine Yenepoya Research Centre Yenepoya (Deemed to be University) University Road Deralakatte Mangalore 575018 India
Role:	

Co-Principal Investigator (2) [Co-PI(2)]	
Full Name: (Title, Forename, Surname)	Rita Tewari
Discipline/expertise:	Unravelling Cell biology of malaria parasite proliferation, invasion and signalling pathways during development within mosquito host. Molecular Parasitology, Reverse genetics, Proteomics
Institution: (Include name of the organisation, department, address, city, country, pin code).	School of Life Sciences, University of Nottingham, Nottingham NG72UH

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2. Team Science Grant Proposal

Q1. Project Title (220 characters max.)

Regulation of *Plasmodium* Cell Cycle and Cell Division by Protein Phosphorylation

Q2. Duration of the grant (in months): 60 (FIXED)

Q3. Start date (DD/MM/YYYY)

01	12	2020
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In case of an award, the PI would have to negotiate a start date with India Alliance. The details would be shared once the award is confirmed.

Q4. Research summary

Please provide a summary of the proposed research, including key goals, for an expert audience (Limit 200 words). *Kindly be aware that India Alliance publishes the synopsis of the awarded grant on its own and on third party websites.*

Malaria parasite *Plasmodium* has an atypical cell cycle and undergoes division, which is very distinct from model eukaryotes like yeast and mammals and is poorly understood. Protein phosphorylation plays a critical role in the division of most organisms. The unique nature of *Plasmodium* division in human and the mosquito host and divergent family of cell cycle PKs presents an exciting possibility to investigate how phosphorylation by PKs and also Protein Phosphatases (PPs) may regulate parasite division in the two different hosts. We propose to study the role of candidate PKs and a PP that are indispensable or are essential for the parasite growth: a. the precise function of PKs and PP in parasite development will be elucidated; b. The targets of these enzymes in the parasite will be identified and characterized and the signaling networks will be dissected; c. how phosphorylation of key substrates by these enzymes regulates their function which in turn is important for parasitic processes will be investigated; d. inhibitors of these PKs which block parasite development in both hosts will be identified. These studies are likely to provide a holistic understanding of parasite division across hosts which may also lead to the development of novel anti-malarials.

Q5. Lay summary

Please provide a summary of the proposed research for a lay audience (Limit 100 words).

Cell division is a fundamental process involved in the development of any organism. We would like to unravel mechanisms by which malaria parasite divides in human and mosquito host. In this context, we will study enzymes known as protein kinases that phosphorylate proteins and alter their function. We would like to learn what certain essential parasite kinases do during parasite division and phosphorylation of which proteins by them is critical for parasite division. These studies will provide novel insights into the biology of *Plasmodium* and may also show the way to tame this parasite in mosquito and human host.

Q6. Details of research project

Please provide full details of the proposal. These should include:

- Background
- Aims and key questions;
- Strategy and Work Plan;

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12. Undertakings from PIs

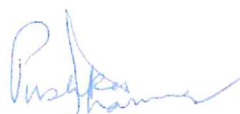
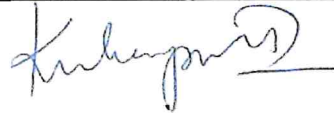
Note: This statement must be signed by all PIs.

UNDERTAKING STATEMENT:

It is confirmed that

1. Those providing personal information in the application have read and understood India Alliance Data Protection Statement.
2. To the best of our knowledge, the information provided in this application is accurate and complete and we agree to inform the India Alliance of any changes to this information during the period of the grant.
3. We agree to abide by the [conditions set by India Alliance](#), should an award be made.
4. We are submitting one PDF application (as per the prescribed guidelines) and the duly filled sections are arranged in following order:

	Sections	Y/N
1.	Team composition and management	Y
2.	Team Science Grant Proposal In response to "Details of project": arrangement is 5000 word write-up, figures and tables, supporting data, timeline, references in prescribed format.	Y
3.	Principal Investigators CV (must have CVs in the prescribed format from PI and Co-PIs; arranged in the mentioned order with clear annotation)	Y
4.	Budget (with justification)	Y
5.	Data management and sharing	Y
6.	Public engagement plan	Y
7.	Research involving human participation	NA
8.	Research involving animals	Y
9.	Risks of research misuse	Y
10.	Conflict of interests	NA
11.	Reviewers and restrictions	Y
12.	Undertakings from PIs signed off by all the participating PIs	Y
13.	Undertakings from all the participating institutions	Y
14.	Additional attachments (Example: letters of support confirming access to clinical facility if needed for project)	NA

	Full name, designation and institution	Signature	Date
Principal Investigator	Pushkar Sharma, Staff Scientist VII, National Institute of Immunology, New Delhi		12.05.20
Co-PI (1)	Rita Tewari, Professor, University of Nottingham, UK		
Co-PI (2)	T. S. Keshava Prasad, Professor, Yenepoya Univeristy, Mangalore		
Co-PI (3)			

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