RAMAIAH
College of Arts, Science
& Commerce

Ref: PO/ 2018-19/66 14.12.2018

CIRCULAR

This is to inform all the faculty members that it has been decided by the Management to give the **SEED MONEY** for the in-house projects by the departments.

In this regard, you may submit the project proposal properly framed to the undersigned to avail this facility. In case your project is approved, seed money will be released to do the project.

Dean of Sciences.

Bcom
BBA 14/12/18
BCA
BA
B.Sc BT
Chem
MB
Maths
Eng

M.Sc Chem & Biochem
PG Chem/Bc

Research and Development Fund (RDF)

Format for submitting the Research Proposal under RDF

*Refer RIT Research Policy and Guidelines before submitting the proposal.
*Structure your Research Proposal based on the headings provided below, use a clear and legible font (e.g. Arial, size 12) and observe the page limit of 5 to 10 pages.

Name of the Principal Investigator	
Qualification	
Affiliation	
Department	
Address , Phone Number and e-mail	
Papers Published in the research area(Attach brief profile)	

Name of the Co-investigator	
Qualification	
Department	
Affiliation	
Address , Phone Number and e-mail	
Papers Published in the research area(Attach brief profile)	

1. Title of the Proposal.....
2. Broad Area of Research .....
3. Sub Area of Research.....

4. Brief Introduction.....(Max 500 words)
5. Background and statement of the problem (this in the light of a thorough National and International literature review)..... (Max 500 words)

6. Research question or hypothesis, aim and objectives..... (Max 300 words).....

7. Research design (type of study)..... (Max 300 words).....

8. Study population and sampling (If applicable).....

9. Data collection methods and instruments..... (Max 300 words).....

10. Data analysis methods – if applicable statistical planning must be fully addressed, or the candidate should provide evidence that statistics are not required

11. Mechanisms to assure the quality of the study – e.g. control of bias, safe storage of data....(Max 300 words)

12. Research Schedule -Bar chart for completion of the project.....

13. Participants in the study – all people involved in the study, and the role they play, should be identified.*.....

14. Ethical considerations.....(Max 300 words) (if applicable)

15. Environmental Issues.....(Max 300 words)

16. Resources required for the study, including budget (Personnel, Consumables, Equipment, Travel, Subcontracting, Provisions, Licensing fees, other).....

Sl. No	**Item**	**BUDGET**			**Amount (In Rupees)**
		1st Year	**2nd Year**	**3rd Year**	**Total**
1.	Equipment				
2.	Consumables				
3.	Research Assistant				
4.	Travel				
5.	Other costs				
	Grand total				

16.1. Justification for the manpower requirement
16.2. Justification for consumable
16.3. Justification for Equipment
16.4. Justification for other costs

17. Scientific Impact, dissemination and potential exploitation (Max 300 words)

18. References.....(Max 20 in **IEEE format**).....

19. Appendices (copy of questionnaire, consent forms, etc.)

*Note 1:***_All proposals are subject to initial screening. If a proposal passes initial screening it is formally accepted as an application and will enter a second screening stage comprising of a high powered committee._**

*Note 2:Submit the completed form(both hard and soft copy in CD) to the Principal, RIT, Bangalore-54.

Endorsement from the Head of Department*
(To be given on letter head)

Project Title: .....

1. Certified that the Department welcomes participation of **Dr/Mr/Mrs**.....as the Principal Investigator and **Mr/ Mrs**.....as the Principal Co-Investigator for the Project and that in the unforeseen event of discontinuance by the Principal Investigator, the Principal Co-Investigator will assume the responsibility of the fruitful completion of the Project.

Date:
Place:

Name and Signature of Head of Department

*Note 3: In regard to the research proposals emanating from various engineering departments, the Head of department is required to provide a justification indicating clearly whether the Research proposal falls in line with the normal research activities of the institution or not and if not, the scientific reasons which merit its consideration.

Certificate from the Investigator

Project Title:.....

1. I/ We agree to abide by the terms and conditions of the research grant.

2. I/ We did not submit the Project proposal elsewhere for financial support.
3. I/ We have explored and ensured that equipment and basic facilities will actually be available as and when required for the purpose of the Projects.
4. I/ We undertake that on permanent equipment will be made available to other users during spare time.

Date:
Place:

Name and signature of Principal Investigator

Date:
Place:

Name and signature of Co- Investigator

(Office use only)

The above project is Approved / Not Approved

Comments:

Signatures of the committee Members

1.

2.

3.

Signature of the Principal

RAMAIAH

Gokula Education Foundation

Inter Office Memo

From: CE, (Engg & GS)	To: Principal, RCASC

Date: 11.12.2019

The proposal of selection of members for panel to guide the students in Research centre @ RCASC is approved. However, a briefing be arranged with experts to finalise the mode of evaluation.

(B.S.Ramaprasad)
Chief Executive

Submissions by Departments

S.No	Departments	Submissions
1	Department of Microbiology	5
2	Department of Biotechnology & Genetics	4
3	Department of Chem-Biochemistry	4
4	Inter-departmental	2
Total		15

Selection Panel – Suggestions- Head of Research - RCASC

S.No	Name	Designation	Specialization
1	Dr.K.Manjunath	Professor, Department of Microbiology & Biotechnology	Mycology, Pollen Allergy, and Bio-control, and Physiology
2	Dr. Chandraprabha	Professor in biotechnology department of MSRIT	Bioprocess engineering, environmental biotechnology, bioprocess modelling & simulation, Nano composites synthesis & application and Nano toxicology.
3	Dr. Sanjay Prasad	Senior Scientific Officer, Inorganic and Physical Chemistry (IPC), IISc.	Nano-biotechnology & Raman Spectroscopy.
4	Dr. Kotam Nagaraju	Associate Professor, Chemistry Dept., RIT	Materials Chemistry and Electrochemistry
5	Dr. KNC Murthy	Chief Scientist, CRL, Ramaiah Medical College and Hospital	Cancer Biology, Molecular Biology, and Signalling.
6	Dr. Angel Beula PR	Senior Clinical Scientist & Genetic Counsellor, RMC& H	Cytogenetics, Genetic Counselling, and Reproductive Biology
7	Dr. Vanitha Gowda MN	Professor & HOD, Department of Biochemistry, RMC	Metabolism and Physiology
8	Dr. Puttaraju HP	Professor, Dept. of Life & Biological Sciences, Bangalore Unviersity	Sericulture, Cell biology, Cytogenetics, and Entomology
9	Dr. Ramakrishnappa T	Associate Professor & HOD, BMS Institute of Technology	Inorganic Chemistry and Materials Science

B. Nagaraja
5/12/19

Committee Recommendations – Head of Research - RCASC

S. No	Domain Areas/Category	Number of Proposals	Title	Committee	Affiliation
1	Growth, Microbiology, and Physiology	2	Effects of cocoa and its products on Anti-oxidation studies in *Drosophila Melanogaster*	Dr. K. Manjunath Dr. Puttaraju H.P	Bangalore University
			Media Formulation for the growth of *Saccharomyces cerevisiae*- an approach for Industrial Research Applications		
2	Molecular Biology, Cancer Biology, Drug Discovery,	3	Molecular Characterization of Cancer Stem Cell Mediated Drug Resistance in Triple Negative Breast Cancer (TNBC)	Dr. KNC Murthy Dr. Vanitha Gowa Dr. Angela Beula	Ramiah Medical College an Hospital (RMC & H)
			Designer Hexapeptides with anti-proliferative activity		
			Structure based design and functional evaluation of potential inhibitors against HPV E6 protein.		
3	Genetics, Reproductive and Development biology	1	Premature Ovarian Failure (POF) mutation detection by exome capture and Next Generation Sequencing (NGS)	Dr. Vanitha Gowda Dr. Angel Beula	Ramaiah Medical College & Hospital (RMC&H)
4	Plant, animal, and Microbial Biotechnology	2	Bioactivity of Ribes nigrum (Black Currant) against microbial complications	Dr. K. Manjunath Dr. Puttaraju H.P	Bangalore University
			"Study and evaluation of Cymbopogon species on Methicillin Resistant *Staphylococcus aureus* (MRSA)"		
5	Mycology	1	Control and detoxification of Mycotoxins in food and feed samples- A Biological approach.	Dr. K. Manjunath Dr. Puttaraju H.P	Bangalore University
6	Sericulture and Biochemistry	1	Effect of radiation and antioxidant diet supplementation on efficacy of silk production in Eri silkworm,	Dr. KNC Murthy Dr. Puttaraju H.P Dr. K. Manjunath	RMC&H BU BU

			Samia cynthia ricini		
7	Materials Chemistry & Electrochemistry	3	Synthesis of metal hydroxides/metal oxides using plant extracts for electrochemical sensors and super capacitors	Dr. Nagabhushana BM Dr. Chandraprabha H Dr. Kottam Nagaraju Dr. Sanjay Prasad	RIT RIT RIT IISc
			Synthesis of Photochromic Coordination Polymers with switchable luminescence properties		
			Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants		
8	Bioremediation and Water biology	2	Bioremediation of Heavy metals from Industrial effluent	Dr. Puttaraju H.P Dr. K. Manjunath	Bangalore University
			Water hyacinth as phytoremediant; Biostimulants, Biocompost, antimicrobial and anti-cancerous agents for lake restoration.		
	Total	15			

			Samia cynthia ricini		
7	Materials Chemistry & Electrochemistry	3	Synthesis of metal hydroxides/metal oxides using plant extracts for electrochemical sensors and super capacitors	Dr. Nagabhushana BM Dr. Chandraprabha H Dr. Kottam Nagaraju Dr. Sanjay Prasad	RIT RIT RIT IISc
			Synthesis of Photochromic Coordination Polymers with switchable luminescence properties		
			Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants		
8	Bioremediation and Water biology	2	Bioremediation of Heavy metals from Industrial effluent	Dr. Puttaraju H.P Dr. K. Manjunath	Bangalore University
			Water hyacinth as phytoremediant; Biostimulants, Biocompost, antimicrobial and anti-cancerous agents for lake restoration.		
	Total	15			

Seed Money Proposals-Theme based submissions-RCASC

S. No	Domain Areas/Category	Number of Proposals	Title	Investigators	Affiliation
1	Growth, Microbiology, and Physiology	2	Effects of cocoa and its products on Anti-oxidation studies in *Drosophila Melanogaster*	Dr. Nagarathna A Dr. Sowbhagya	Department of Biotechnology & Genetics, RCASC
			Media Formulation for the growth of *Saccharomyces cerevisiae*- an approach for Industrial Research Applications	Dr. Prasanna Srinivas Dr. Geetika Pant	Department of Microbiology, RCASC. Department of Biotechnology & Genetics, RCASC
2	Molecular Biology, Cancer Biology, Drug Discovery,	3	Molecular Characterization of Cancer Stem Cell Mediated Drug Resistance in Triple Negative Breast Cancer (TNBC)	Dr. Vasanth K Bhaskara Dr. Vijaya V Mysorekar	Department of Chem-Biochemistry, RCASC Ramaiah Medical College & Hospital (RMC&H)
			Designer Hexapeptides with anti-proliferative activity	Dr. Nishita, Dr. Vemula Vani Dr. Manonmani (External, Retired)	Department of Microbiology, RCASC.
			Structure based design and functional evaluation of potential inhibitors against HPV E6 protein.	Dr. Vemula Vani, Dr. Nishita	Department of Microbiology, RCASC.

S. No	Domain Areas/Category	Number of Proposals	Title	Investigators	Affiliation
3	Genetics, Reproductive and Development biology	1	Premature Ovarian Failure (POF) mutation detection by exome capture and Next Generation Sequencing (NGS)	Dr. Krishna Rao Jagarlamudi Dr. Nagagireesh Bojanala Dr. Sujani Dr. KNC Murthy	Department of Chem-Biochemistry, RCASC Department of Biotechnology & Genetics, RCASC Ramaiah Medical College & Hospital (RMC&H)
4	Plant, animal, and Microbial Biotechnology	2	Bioactivity of Ribes nigrum (Black Currant) against microbial complications	Dr. Akshatha KN and Dr. Bhargavi	Department of Microbiology, RCASC.
			"Study and evaluation of Cymbopogon species on Methicillin Resistant *Staphylococcus aureus* (MRSA)"	Dr. Vinutha M	Department of Biotechnology & Genetics, RCASC
5	Mycology	1	Control and detoxification of Mycotoxins in food and feed samples- A Biological approach.	Dr. Nirmala Devi and Dr. Manjunath	Department of Microbiology, RCASC.
6	Sericulture and Biochemistry	1	Effect of radiation and antioxidant diet supplementation on efficacy of silk production in Eri silkworm, *Samia cynthia ricini*	Dr. Raha Dayanidhi Dr. Santosh Anand	Department of Biotechnology & Genetics, RCASC
7	Materials Chemistry & Electrochemistry	3	Synthesis of metal hydroxides/metal oxides using plant extracts for electrochemical sensors and super capacitors	Dr. Vijay Kumar Reddy	Department of Chem-Biochemistry, RCASC
			Synthesis of Photochromic Coordination Polymers with switchable luminescence properties	Dr. Asha K S and Mr. Prasanna Kumar SG	Department of Chem-Biochemistry, RCASC
			Synthesis of photo catalytic metal organic	Dr. Asha K S and	Department of

			Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants	Dr. Asha K S and Mr. Prasanna Kumar SG	Department of Chem-Biochemistry, RCASC
8	Bioremediation and Water biology	2	Bioremediation of Heavy metals from Industrial effluent	Dr. Soumya Dr. Sravanthi Dr.Ahalya	Department of Microbiology, RCASC. Department of Biotechnology, MSRIT
			Water hyacinth as phytoremediant; Biostimulants, Biocompost, antimicrobial and anti-cancerous agents for lake restoration.	Dr. Ramakrishna Mr. Surendra	Department of Biotechnology & Genetics, RCASC Department of Chem-Biochemistry, RCASC
	Total	15			

Budget :- 1,15,743/-

Revd*

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Vinutha M
Department	Biotechnology& Genetics
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Akshatha KN
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Study and evaluation of Cymbopogon species on Methicillin Resistant Staphylococcus aureus (MSRA)	

Excellent 5; Very Good 4; Good 3; Fair 2; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1	**Introduction & Rationale** *(Background, Problem Statement, and aims/objectives)*		✓				
2	**Literature Review** *(Relevance, recent developments, and organization of issues, etc.)*			✓			
3	**Research Methodology** *(Appropriateness of methods and experimental design, etc.)*		✓				
4	**Feasibility of study & Preliminary results** *(Suitability to scope, aims, resources, outcomes, and practicality)*		✓				
5	**Expertise of PI/Co-PI** *(Expertise, publications, and networking)*		✓				
6	**Impact on Socio-Economic issues**			✓			
7	**Budget**			✓			
8	* **Overall Performance** *(Presentation skills, proactiveness, and confidence in Q &A session, etc.)*		✓				
		Total					29/40

OVERALL DECISION (□ tick the appropriate box)	□ SATISFACTORY	□✓ SATISFACTORY* *With minor amendments/ comments to improve*	□ UNSATISFACTORY *(less than 20 marks)*

*Point 8 will be graded during assessment of individual presentations

Signature of Panel Member:

Name of Panel Member: Dr. Angel Beula P.R ***Date: 25/2/2020***

Please provide comments for candidate reference/improvements on the proposal

Title of the project:

Study and evaluation of Cymbopogon species on Methicillin Resistant Staphylococcus aureus (MSRA)

Comments: The proposal is satisfactory with minor amendments and improvisation

Signature of Panel Member:

Name of Panel Member: Dr. Angel Beula P.R

Date: 25/2/2020

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Vinutha M
Department	Biotechnology& Genetics
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Akshatha KN
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Study and evaluation of Cymbopogon species on Methicillin Resistant Staphylococcus aureus (MSRA)	

Excellent 5; Very Good 4; Good 3; Fair 2; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1	**Introduction & Rationale** *(Background, Problem Statement, and aims/objectives)*		✓				4
2	**Literature Review** *(Relevance, recent developments, and organization of issues, etc.)*		✓				4
3	**Research Methodology** *(Appropriateness of methods and experimental design, etc.)*		✓				4
4	**Feasibility of study & Preliminary results** *(Suitability to scope, aims, resources, outcomes, and practicality)*			✓			3
5	**Expertise of PI/Co-PI** *(Expertise, publications, and networking)*		✓				4
6	**Impact on Socio-Economic issues**			✓			3
7	**Budget**			✓			3
8	* **Overall Performance** *(Presentation skills, proactiveness, and confidence in Q &A session, etc.)*			✓			3
			Total				28/40

OVERALL DECISION (□ tick the appropriate box)	☐ SATISFACTORY	☑ SATISFACTORY* *With minor amendments/ comments to improve*	☐ UNSATISFACTORY *(less than 20 marks)*

**Point 8 will be graded during assessment of individual presentations*

Signature of Panel Member: 

Name of Panel Member: K.N. Chidambara Murthy ***Date:*** 12/01/2020

Please provide comments <u>for candidate</u> reference/improvements on the proposal

<u>Title of the project:</u>

Study and evaluation of Cymbopogon species on Methicillin Resistant Staphylococcus aureus (MSRA)

<u>Comments:</u>

Proposal looks good, However to get Seed grant following information could be considered.

→ Depicting larger picture of project.
→ projection in to use of natural molecules to address drug resistance to be increased
→ why only one plant specii ?
→ If oil is commercially available use the same for activity
→ Proper extrapolation of more to clin pathogenic strains of S.aureus.
→ Exploring the mechanism of antimicrob activity would provide better utility.
→ Objectives can be broder to attain major outcomes (3-4).

Signature of Panel Member: _____

Name of Panel Member: K.N.Chidambara Murthy ***Date:*** 12/1/2020

Research and Development Fund

Confidential report

(To be sent in sealed envelope to Honorable Chief Executive)

Name of the Principal Investigator	Dr. Vinutha M
Department	Biotechnology& Genetics
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Akshatha KN
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Study and evaluation of Cymbopogon species on Methicillin Resistant Staphylococcus aureus (MSRA)	

Please provide a summary of the proposal highlighting strengths, weaknesses, scope for individual growth, and overall impact on organizational and societal development- for management review (max 150 words).

1. Proposal writing needs some guidance and the PI & co-PI need made good effort.
2. If small training on proposal format & writing would help

Signature of Panel Member: D.S.J.

Name of Panel Member: K.N. Chidambara Murthy ***Date:*** 13/01/2020.

Research and Development Fund

Confidential report

(To be sent in sealed envelope to Honorable Chief Executive)

Name of the Principal Investigator	Dr. Vinutha M
Department	Biotechnology& Genetics
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Akshatha KN
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Study and evaluation of Cymbopogon species on Methicillin Resistant Staphylococcus aureus (MSRA)	

Please provide a summary of the proposal highlighting strengths, weaknesses, scope for individual growth, and overall impact on organizational and societal development- for management review (max 150 words).

Comments: The proposal is satisfactory with minor amendments and improvisation

Signature of Panel Member:

Name of Panel Member: Dr. Angel Beula P.R

Date: 25/2/2020

Budget → 4.0 lacks

↓ Revised to → 3.0 Lacs

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Krishna Rao Jagarlamudi
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Nagagireesh Bojanala
Department	Biotechnology & Genetics
Affiliation	RCASC
Title of the Proposal	
Premature Ovarian Failure (POF) mutation detection by exome capture and next generation sequencing	

Excellent 5; Very Good 4; Good 3; Fair 2; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1	**Introduction & Rationale** *(Background, Problem Statement, and aims/objectives)*		✓				
2	**Literature Review** *(Relevance, recent developments, and organization of issues, etc.)*		✓				
3	**Research Methodology** *(Appropriateness of methods and experimental design, etc.)*	✓					
4	**Feasibility of study & Preliminary results** *(Suitability to scope, aims, resources, outcomes, and practicality)*	✓					
5	**Expertise of PI/Co-PI** *(Expertise, publications, and networking)*		✓				
6	**Impact on Socio-Economic issues**	✓					
7	**Budget**		✓				
8	* **Overall Performance** *(Presentation skills, proactiveness, and confidence in Q &A session, etc.)*		✓				
		Total					35/40

OVERALL DECISION (□ tick the appropriate box)	□✓ SATISFACTORY	□ SATISFACTORY* *With minor amendments/ comments to improve*	□ UNSATISFACTORY *(less than 20 marks)*

*Point 8 will be graded during assessment of individual presentations

Signature of Panel Member:

Name of Panel Member: Dr. Angel Beula P.R ***Date: 25/2/2020***

Please provide comments for candidate reference/improvements on the proposal

Title of the project:

Premature Ovarian Failure (POF) mutation detection by exome capture and next generation sequencing

Comments:The proposal is satisfactory. The key findings from this study will help in combating infertility issues in Indian Women. On a small note, the proposal needs minor improvisation on broader application of genetic tests methods.

Signature of Panel Member:

Name of Panel Member: Dr. Angel Beula P.R ***Date: 25/2/2020***

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Krishna Rao Jagarlamudi
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Nagagireesh Bojanala
Department	Biotechnology & Genetics
Affiliation	RCASC
Title of the Proposal	
Premature Ovarian Failure (POF) mutation detection by exome capture and next generation sequencing	

Excellent 5; Very Good 4; Good 3; Fair 2; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1	**Introduction & Rationale** *(Background, Problem Statement, and aims/objectives)*		✓				4
2	**Literature Review** *(Relevance, recent developments, and organization of issues, etc.)*		✓				4
3	**Research Methodology** *(Appropriateness of methods and experimental design, etc.)*	✓					5
4	**Feasibility of study & Preliminary results** *(Suitability to scope, aims, resources, outcomes, and practicality)*		✓				4
5	**Expertise of PI/Co-PI** *(Expertise, publications, and networking)*		✓				4
6	**Impact on Socio-Economic issues**		✓				4
7	**Budget**		✓				4
8	* **Overall Performance** *(Presentation skills, proactiveness, and confidence in Q &A session, etc.)*		✓				4
			Total				33/40

OVERALL DECISION (☐ tick the appropriate box)	SATISFACTORY ☑	SATISFACTORY* *With minor amendments/ comments to improve* ☐	UNSATISFACTORY *(less than 20 marks)* ☐

Point 8 will be graded during assessment of individual presentations

Signature of Panel Member: _____

Name of Panel Member: Prof. H.P. Puttaraju **Date:** 20/02/2020

Candidate Reference Report:

Project Title :**Premature ovarian failure mutation detection by exome capture and next generation sequencing.**

By : Dr. Krishna Rao Jagarlamudi and Dr. Nagagireesh Bojanala

1	Title and Objectives	:	The Title and objectives are well defined.
2	Introduction and Rationale	:	Introduction is appropriate to the title/research project
3	Literature Review		Literature survey is relevant and adequate
4	Methodology	:	Standard protocols are referred
5	Work Plan	:	The work plan is appropriatelyplanned
6	Relevance to scientific excellence	:	On-par
7	Product / Process development	:	The outcome will play a significant role in the field of infertility.
8	Socio-economic importance Application oriented	:	The significance of the outcome may directly influence the Socio-economic aspects
9	Expertise of PI / Co – PI's	:	Adequate
10	Budgetary detail	:	Justified
11	Specific comments / observations	:	How would you correlate any mutation detected other than the 550 genes related to POF.

Research and Development Fund

Confidential report

(To be sent in sealed envelope to Honorable Chief Executive)

Name of the Principal Investigator	Dr. Krishna Rao Jagarlamudi
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Nagagireesh Bojanala
Department	Biotechnology & Genetics
Affiliation	RCASC
Title of the Proposal	
Premature Ovarian Failure (POF) mutation detection by exome capture and next generation sequencing	

Please provide a summary of the proposal highlighting strengths, weaknesses, scope for individual growth, and overall impact on organizational and societal development- for management review (max 150 words).

Based on the evaluation of the project proposal, I offer my comments as follows:

i. The experimental studies to be carried out are relevant in the current context of research in the chosen area and the results have high application potentials.

The deliverables of the project can have positive implications on the society. The outcome of the proposal can be published in highly reputed journals which can bring laurels and recognition to the Institute.

ii. The candidate has proposed the project clearly and without ambiguity.

iii. **Hence I recommend the proposal for funding**

The Title and objectives are well defined, Introduction is appropriate to the title/research project, Literature survey is relevant and adequate, Standard protocols are referred, The work is appropriately planned, The outcome will play a significant role in the field of infertility. The significance of the outcome may directly influence the Socio-economic aspects. Budget is well justified.

Specific comments / observations : How would you correlate any mutation detected other than the 550 genes related to POF.

Signature of Panel Member: _____

Name of Panel Member: Dr. H. P. Puttaraju **Date:** 9-02-2020

Prof. H.P. PUTTARAJU Ph.D., FRES
UGC-BSR Faculty Fellow
Dept. of Studies in Life Science
Bangalore University
Jnana Bharathi 560056

Candidate Reference Report:

Project Title : **Premature ovarian failure mutation detection by exome capture and next generation sequencing.**

By : Dr. Krishna Rao Jagarlamudi and Dr. Nagagireesh Bojanala

1	Title and Objectives	:	The Title and objectives are well defined.
2	Introduction and Rationale	:	Introduction is appropriate to the title/research project
3	Literature Review		Literature survey is relevant and adequate
4	Methodology	:	Standard protocols are referred
5	Work Plan	:	The work plan is appropriately planned
6	Relevance to scientific excellence	:	On-par
7	Product / Process development	:	The outcome will play a significant role in the field of infertility.
8	Socio-economic importance Application oriented	:	The significance of the outcome may directly influence the Socio-economic aspects
9	Expertise of PI / Co – PI's	:	Adequate
10	Budgetary detail	:	Justified
11	Specific comments / observations	:	How would you correlate any mutation detected other than the 550 genes related to POF.

Prof. H.P. PUTTARAJU Ph.D., FRES
UGC-BSR Faculty Fellow
Dept. of Studies in Life Science
Bangalore University
Bengaluru 560056

Research and Development Fund

Confidential report

(To be sent in sealed envelope to Honorable Chief Executive)

Name of the Principal Investigator	Dr. Krishna Rao Jagarlamudi
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Nagagireesh Bojanala
Department	Biotechnology & Genetics
Affiliation	RCASC
Title of the Proposal	
Premature Ovarian Failure (POF) mutation detection by exome capture and next generation sequencing	

Please provide a summary of the proposal highlighting strengths, weaknesses, scope for individual growth, and overall impact on organizational and societal development- for management review (max 150 words).

The proposal is satisfactory with minor improvisation on broader application of genetic tests methods

Signature of Panel Member: _____

Name of Panel Member: Dr. Angel Beula P.R ***Date: 25/2/2020***

Budget - 4.5 lakhs
↓ Revised to 3.1 Lakhs

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Nirmala Devi
Department	Microbiology
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Manjunath A S
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Control and detoxification of Mycotoxins in food and feed- A biological approach	

Excellent 5; Very Good 4; Good 3; Fair 2; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1	**Introduction & Rationale** *(Background, Problem Statement, and aims/objectives)*	5					5
2	**Literature Review** *(Relevance, recent developments, and organization of issues, etc.)*		4				4
3	**Research Methodology** *(Appropriateness of methods and experimental design, etc.)*		4				4
4	**Feasibility of study & Preliminary results** *(Suitability to scope, aims, resources, outcomes, and practicality)*		4				4
5	**Expertise of PI/Co-PI** *(Expertise, publications, and networking)*		4				4
6	**Impact on Socio-Economic issues**		4				4
7	**Budget** Equipments to be purchased centrally						4
8	***Overall Performance** *(Presentation skills, proactiveness, and confidence in Q &A session, etc.)*						
				Total			/40

29/35

OVERALL DECISION (☐ tick the appropriate box)	☑ SATISFACTORY	☐ SATISFACTORY* *With minor amendments/ comments to improve*	☐ UNSATISFACTORY *(less than 20 marks)*

*Point 8 will be graded during assessment of individual presentations

Signature of Panel Member: _____

Name of Panel Member: _____ **Date:** _____

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Nirmala Devi
Department	Microbiology
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Manjunath A S
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Control and detoxification of Mycotoxins in food and feed- A biological approach	

Excellent 5; Very Good 4; Good 3; Fair 2; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1	**Introduction & Rationale** *(Background, Problem Statement, and aims/objectives)*		✓				4
2	**Literature Review** *(Relevance, recent developments, and organization of issues, etc.)*		✓				4
3	**Research Methodology** *(Appropriateness of methods and experimental design, etc.)*		✓				4
4	**Feasibility of study & Preliminary results** *(Suitability to scope, aims, resources, outcomes, and practicality)*			✓			3
5	**Expertise of PI/Co-PI** *(Expertise, publications, and networking)*		✓				4
6	**Impact on Socio-Economic issues**		✓				4
7	**Budget**		✓				4
8	* **Overall Performance** *(Presentation skills, proactiveness, and confidence in Q &A session, etc.)*		✓				4
			Total				31/40

OVERALL DECISION (☐ tick the appropriate box)	☑ SATISFACTORY	☐ SATISFACTORY* *With minor amendments/ comments to improve*	☐ UNSATISFACTORY *(less than 20 marks)*

*Point 8 will be graded during assessment of individual presentations

Signature of Panel Member: _____

Name of Panel Member: Prof. H. P. Puttaraju **Date:** 20/02/2020

Candidate Reference Report:

Project Title : **Control and detoxification of mycotoxins in food and feed –A biological approach**

By : Dr. D. Nirmala Devi and Dr. A.S. Manjunath.

1	Title and Objectives	:	The Title and objectives are well defined.
2	Introduction and Rationale	:	Introduction is appropriate to the title/research project
3	Literature Review		Literature survey is relevant and adequate
4	Methodology	:	Standard protocols are referred
5	Work Plan	:	The work plan is appropriately planned
6	Relevance to scientific excellence	:	Just on-par and can be significantly improved
7	Product / Process development	:	The outcome may play a significant role
9	Expertise of PI / Co – PI's	:	Adequate
10	Budgetary detail	:	Justified
12	General comments/Suggestions	:	The proposal is well written and the investigator has adequate expertise and has good publications.

Research and Development Fund

Confidential report

(To be sent in sealed envelope to Honorable Chief Executive)

Name of the Principal Investigator	Dr. Nirmala Devi
Department	Microbiology
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Manjunath A S
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Control and detoxification of Mycotoxins in food and feed- A biological approach	

Please provide a summary of the proposal highlighting strengths, weaknesses, scope for individual growth, and overall impact on organizational and societal development- for management review (max 150 words).

Based on the evaluation of the project proposal, I offer my comments as follows:

i. The experimental studies to be carried out are relevant in the current context of research in the chosen area and the results have high application potentials.

The deliverables of the project can have positive implications on the society. It can bring down the losses occurred in the total food production to some extent. Food being essential commodity, the proposal has a greater value.

The outcome of the proposal can be published in highly reputed journals which can bring recognition to the Institute.

ii. The candidate has proposed the project clearly and without ambiguity.

iii. **Hence I recommend the proposal for funding**

The proposal is well written and the investigator has adequate expertise and has good publications.

Signature of Panel Member: _____

Name of Panel Member: Prof. H.P. Puttaraju ***Date:*** 19-02-2020

Prof. H.P. PUTTARAJU Ph.D., FRES
UGC-BSR Faculty Fellow
Dept. of Studies in Life Science
Bangalore University

Budget - 3.0 lakhs
↓ Revised to 1.5 lakhs

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College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Vasanth K Bhaskara
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Vijaya V. Mysorekar
Department	Pathology
Affiliation	Ramaiah Medical College & Hospital
Title of the Proposal	
Molecular Characterization of cancer stem cell mediated drug resistance in Triple Negative Breast Cancer (TNBC)	

Excellent 5; Very Good 4; Good 3; Fair 2; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1	**Introduction & Rationale** *(Background, Problem Statement, and aims/objectives)*		✓				4
2	**Literature Review** *(Relevance, recent developments, and organization of issues, etc.)*			✓			3
3	**Research Methodology** *(Appropriateness of methods and experimental design, etc.)*			✓			3
4	**Feasibility of study & Preliminary results** *(Suitability to scope, aims, resources, outcomes, and practicality)*			✓			3
5	**Expertise of PI/Co-PI** *(Expertise, publications, and networking)*		✓				4
6	**Impact on Socio-Economic issues**			✓			3
7	**Budget**			✓			3
8	* **Overall Performance** *(Presentation skills, proactiveness, and confidence in Q &A session, etc.)*			✓			3
				Total			26/40

OVERALL DECISION (□ tick the appropriate box)	□ SATISFACTORY	☑ SATISFACTORY* *With minor amendments/ comments to improve*	□ UNSATISFACTORY *(less than 20 marks)*

**Point 8 will be graded during assessment of individual presentations*

Signature of Panel Member: _____

Name of Panel Member: KVC Murthy ***Date:*** 07/02/2020

Please provide comments <u>for candidate</u> reference/improvements on the proposal

<u>Title of the project:</u>

Molecular Characterization of cancer stem cell mediated drug resistance in Triple Negative Breast Cancer (TNBC)

<u>Comments:</u>

The Researchers are attempting to understand the benefits of natural molecule known for its health benefit in Breast Cancer. Concept, approach and design of experiments looks great. Resveratrol is well known for its antioxidant activity. However its <u>use</u> in grapes and dry fruit ingredients is very low. They need to also see the mode for utilizing the products to reach clinical benefits. Similar work is in progress at CRL, Medical college and they can use some of facility from here.

Signature of Panel Member: _____

Name of Panel Member: ICMC Murthy ***Date:*** 08/02/2020.

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& Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Vasanth K Bhaskara
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Vijaya V. Mysorekar
Department	Pathology
Affiliation	Ramaiah Medical College & Hospital
Title of the Proposal	
Molecular Characterization of cancer stem cell mediated drug resistance in Triple Negative Breast Cancer (TNBC)	

Excellent 5; Very Good 4; Good 3; Fair 2; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1	**Introduction & Rationale** *(Background, Problem Statement, and aims/objectives)*		✓				4
2	**Literature Review** *(Relevance, recent developments, and organization of issues, etc.)*		✓				4
3	**Research Methodology** *(Appropriateness of methods and experimental design, etc.)*		✓				4
4	**Feasibility of study & Preliminary results** *(Suitability to scope, aims, resources, outcomes, and practicality)*	✓					5
5	**Expertise of PI/Co-PI** *(Expertise, publications, and networking)*	✓					5
6	**Impact on Socio-Economic issues**		✓				4
7	**Budget**		✓				4
8	* **Overall Performance** *(Presentation skills, proactiveness, and confidence in Q &A session, etc.)*		✓				4
		Total					34/40

OVERALL DECISION (□ tick the appropriate box)	SATISFACTORY ☑	SATISFACTORY* *With minor amendments/ comments to improve* ☐	UNSATISFACTORY *(less than 20 marks)* ☐

**Point 8 will be graded during assessment of individual presentations*

Signature of Panel Member: _____

Name of Panel Member: Dr Vanitha Gowda. ***Date:*** 28/2/2020

Please provide comments <u>for candidate</u> reference/improvements on the proposal

<u>Title of the project:</u>

Molecular Characterization of cancer stem cell mediated drug resistance in Triple Negative Breast Cancer (TNBC)

<u>Comments:</u>

- A well drafted protocol.
- Having Dr Vijaya Nayakar or your team will enhance the potential for perfection, skill & expertise & consistency required for this project.

Signature of Panel Member: _____

Name of Panel Member: Dr Vanitha Gowda ***Date:*** 28 | 2 | 2020

Research and Development Fund

Confidential report

(To be sent in sealed envelope to Honorable Chief Executive)

Name of the Principal Investigator	Dr. Vasanth K Bhaskara
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Vijaya V. Mysorekar
Department	Pathology
Affiliation	Ramaiah Medical College & Hospital
Title of the Proposal	
Molecular Characterization of cancer stem cell mediated drug resistance in Triple Negative Breast Cancer (TNBC)	

Please provide a summary of the proposal highlighting strengths, weaknesses, scope for individual growth, and overall impact on organizational and societal development- for management review (max 150 words).

Authors have submitted a good proposal to understand benefit of resveratrol on TNBC. They have mixed 2 proposal, If the research stock to cell based proposal it would be good Screening of natural molecule may not be required for this project.
Proposal needs to focus on one bigger objective then too many.

Signature of Panel Member: _____

Name of Panel Member: ICNC Unity **Date:** 07/02/2020.

Research and Development Fund

Confidential report

(To be sent in sealed envelope to Honorable Chief Executive)

Name of the Principal Investigator	Dr. Vasanth K Bhaskara
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Vijaya V. Mysorekar
Department	Pathology
Affiliation	Ramaiah Medical College & Hospital
Title of the Proposal	
Molecular Characterization of cancer stem cell mediated drug resistance in Triple Negative Breast Cancer (TNBC)	

Please provide a summary of the proposal highlighting strengths, weaknesses, scope for individual growth, and overall impact on organizational and societal development- for management review (max 150 words).

The features of this study proposal are

1. It deals with a very commonly encountered problem of cancer drug resistance and metastasis in a disease -Breast Cancer has recently overtaken Cervical Cancer as the commonest cancer amongst women in India.
2. The research question raised here seems very logical and is drafted well.
3. The assay proposed to be used and the techniques are fairly of recent and good standards.
4. Would definitely allow the investigators to pursue research in this field for many years in the future.
5. Has a good societal impact as it proposes to use triple-negative breast cancer (TNBC) cells, that is more prevalent among younger age women, is the most aggressive form, having poor prognoses and high recurrence rate. The incidence of TNBC shows no signs of regress.
6. If the research is done earnestly, it has a good potential of publication and would bring a good name for the institution.

Signature of Panel Member: Vanitha Gowda. M.N

Name of Panel Member: DR VANITHA GOWDA.MN ***Date:*** 29/2/2020.

Professor and Head
Department of Biochemistry
M.S. Ramaiah Medical College
Bangalore - 560 054

Requests - 13-87 lakhs
Budget - 3-87 lakhs
Revised

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. VemulaVani
Department	Microbiology
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Nishitha KP
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Structure based design and functional evaluation of potential inhibitors against HPV E6 protein	

Excellent 5; Very Good 4; Good 3; Fair 2; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1	**Introduction & Rationale** *(Background, Problem Statement, and aims/objectives)*		✓				4
2	**Literature Review** *(Relevance, recent developments. and organization of issues, etc.)*		✓				4
3	**Research Methodology** *(Appropriateness of methods and experimental design, etc.)*		✓				5
4	**Feasibility of study & Preliminary results** *(Suitability to scope, aims, resources, outcomes, and practicality)*		✓				4
5	**Expertise of PI/Co-PI** *(Expertise, publications, and networking)*			✓			3
6	**Impact on Socio-Economic issues**			✓			3
7	**Budget**				✓		2
8	* **Overall Performance** *(Presentation skills, proactiveness, and confidence in Q &A session, etc.)*			✓			3
			Total				28/40

OVERALL DECISION (☐ tick the appropriate box)	☐ SATISFACTORY	☑ SATISFACTORY* *With minor amendments/ comments to improve*	☐ UNSATISFACTORY *(less than 20 marks)*

**Point 8 will be graded during assessment of individual presentations*

Signature of Panel Member: _____

Name of Panel Member: Dr. K.N. Chowdary ***Date:*** 02/02/2020.

Please provide comments <u>for candidate</u> reference/improvements on the proposal

<u>Title of the project:</u>

Structure based design and functional evaluation of potential inhibitors against HPV E6 protein

<u>Comments:</u>

Proposal is written for novel drug develop based on the work done by the members of the research team and others. Concept and approach looks good. Since the techniques mentioned in the proposed are expensive, It is better to get advanced analysis from Collaborating Institute (IISc). Also work using human Specimen's / Sample may provide better understanding.

Overall good proposed.

Budget - 3.87 lakhs
(Tissue culture facility - 10 lakhs?)
Total - 13.87 lakhs

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College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. VemulaVani
Department	Microbiology
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Nishitha KP
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Structure based design and functional evaluation of potential inhibitors against HPV E6 protein	

Excellent 5; Very Good 4; Good 3; Fair 2; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1	**Introduction & Rationale** *(Background, Problem Statement, and aims/objectives)*	✓					5
2	**Literature Review** *(Relevance, recent developments, and organization of issues, etc.)*		✓				4
3	**Research Methodology** *(Appropriateness of methods and experimental design, etc.)*		✓				4
4	**Feasibility of study & Preliminary results** *(Suitability to scope, aims, resources, outcomes, and practicality)*	✓					5
5	**Expertise of PI/Co-PI** *(Expertise, publications, and networking)*		✓				4
6	**Impact on Socio-Economic issues**	✓					5
7	**Budget**		✓				4
8	* **Overall Performance** *(Presentation skills, proactiveness, and confidence in Q &A session, etc.)*		✓				4
		Total					35/40

OVERALL DECISION (☐ tick the appropriate box)	☐ SATISFACTORY ✓	☐ SATISFACTORY* *With minor amendments/ comments to improve*	☐ UNSATISFACTORY *(less than 20 marks)*

*Point 8 will be graded during assessment of individual presentations

Signature of Panel Member: Vanitha. Gowda. P.N

Name of Panel Member: Dr VANITHA. GOWDA **Date:** 28/2/2020

Research and Development Fund

Confidential report

(To be sent in sealed envelope to Honorable Chief Executive)

Name of the Principal Investigator	Dr. VemulaVani
Department	Microbiology
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Nishitha KP
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Structure based design and functional evaluation of potential inhibitors against HPV E6 protein	

Please provide a summary of the proposal highlighting strengths, weaknesses, scope for individual growth, and overall impact on organizational and societal development- for management review (max 150 words).

The features of the study proposal are

1. It deals with drug designing and development in Cervical cancer- a very relevant case scenario that women from our country, specially from the lower socioeconomic stratum, are suffering from.
2. A collaboration with the prestigious IISc and Maharani Lakshmi Ammanni College which can be for-seen to progress in a direction that is favourable for the Ramaiah group of institutions.
3. Logically and rationally planned research proposal- proposes the use latest technology.

Signature of Panel Member: Vanitha Gowda. M.N

Name of Panel Member: DR. VANITHA GOWDA. M.N. **Date:** 29/2/2020.

Professor and Head
Department of Biochemistry
M.S. Ramaiah Medical College
Bangalore-560 054

Research and Development Fund

Confidential report

(To be sent in sealed envelope to Honorable Chief Executive)

Name of the Principal Investigator	Dr. VemulaVani
Department	Microbiology
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Nishitha KP
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Structure based design and functional evaluation of potential inhibitors against HPV E6 protein	

Please provide a summary of the proposal highlighting strengths, weaknesses, scope for individual growth, and overall impact on organizational and societal development- for management review (max 150 words).

- Proposal is of good quality and the basic work done based on the proposed objectives needs to be linked to clinical applications.
- Optimal utilization of resources at RCASC and IISc is critical for the proposal.
- Clinical/practical integration will help in good publication and quality of Outcome

Signature of Panel Member:

Name of Panel Member: Dr. KVG Murty **Date:** 02/02/2020.

Budget - 5.36 lakhs
↳ Revised to → 3.26 lakhs

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College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Asha K S
Department	Chemistry and Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Mr. Prasanna Kumar SG
Department	Chemistry and Biochemistry
Affiliation	RCASC
Title of the Proposal	
Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants	

Excellent 5; Very Good 4; Good 3; Fair 2; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1	**Introduction & Rationale** *(Background, Problem Statement, and aims/objectives)*						4
2	**Literature Review** *(Relevance, recent developments, and organization of issues, etc.)*						3
3	**Research Methodology** *(Appropriateness of methods and experimental design, etc.)*						4
4	**Feasibility of study & Preliminary results** *(Suitability to scope, aims, resources, outcomes, and practicality)*						4
5	**Expertise of PI/Co-PI** *(Expertise, publications, and networking)*						5
6	**Impact on Socio-Economic issues**						5
7	**Budget**						5
8	* **Overall Performance** *(Presentation skills, proactiveness, and confidence in Q &A session, etc.)*						5
		Total					35/40

OVERALL DECISION (☐ tick the appropriate box)	☐ SATISFACTORY	☑ SATISFACTORY* *With minor amendments/ comments to improve*	☐ UNSATISFACTORY *(less than 20 marks)*

*Point 8 will be graded during assessment of individual presentations

Signature of Panel Member: Ramakrishnappa T

Name of Panel Member: Dr.Ramakrishnappa.TDate:10-02-2020

Please provide **comments for candidate reference/improvements on the proposal**

Title of the project:

Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants

Comments: The current topic chosen by the PI is very much needed for the society. This is because the pollution, especially water pollution is the burning problem in almost all parts of the world. For this we have to appreciate the PI. Then PI has expertise in the MOF synthesis and studying their properties. However, the PI did not convince the dominant characters of the MOFs over other reported or existed photocatalysts for water pollution control. Numerous photocatalysts are coming into the market and exhibiting good photocatalytic properties for degradation studies. So, the PI should mention this in their proposal.

Signature of Panel Member: _____ Ramakrishnappa T

Name of Panel Member: Dr.Ramakrishnappa.TDate: 10-02-2020

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College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Asha K S
Department	Chemistry and Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Mr. Prasanna Kumar SG
Department	Chemistry and Biochemistry
Affiliation	RCASC
Title of the Proposal	
Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants	

Excellent 5; Very Good 4; Good 3; Fair 2; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1	**Introduction & Rationale** *(Background, Problem Statement, and aims/objectives)*						3
2	**Literature Review** *(Relevance, recent developments, and organization of issues, etc.)*						1
3	**Research Methodology** *(Appropriateness of methods and experimental design, etc.)*						2
4	**Feasibility of study & Preliminary results** *(Suitability to scope, aims, resources, outcomes, and practicality)*						2
5	**Expertise of PI/Co-PI** *(Expertise, publications, and networking)*						3
6	**Impact on Socio-Economic issues**						3
7	**Budget**						3
8	***Overall Performance** *(Presentation skills, proactiveness, and confidence in Q &A session, etc.)*						
		Total					/40

OVERALL DECISION (☐ tick the appropriate box)	☐ SATISFACTORY	☐ SATISFACTORY* *With minor amendments/ comments to improve*	☐ UNSATISFACTORY *(less than 20 marks)*

Point 8 will be graded during assessment of individual presentations

17/35

Signature of Panel Member: _____

Name of Panel Member: Sanjay Prasad **Date:** 27/01/20202

Please provide comments <u>for candidate</u> reference/improvements on the proposal

<u>Title of the project:</u>

Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants

<u>Comments:</u>

The project is very much feasible, and the objective of the project is achievable too. Dr. K. S. Asha has good experience in the similar area.

The PI should have given more detail on the background on the project. It is always appreciated if the PI would have compared their methodology with the existing methods and provided some insight. There is no discussion about the other available methods to treat waste water. The authors have not mentioned the implications of the usage of chromium, which itself is a pollutant in waste water, in their project. Methodology should have been elaborated and discussed in detail.

The time frame and the budget mentioned in the project is very appropriate.

Signature of Panel Member: _____

Name of Panel Member: ***<u>Sanjay Prasad</u>*** ***Date:*** ***<u>27/01/20202</u>***

Research and Development Fund

Confidential report

(To be sent in sealed envelope to Honorable Chief Executive)

Name of the Principal Investigator	Dr. Asha K S
Department	Chemistry and Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Mr. Prasanna Kumar SG
Department	Chemistry and Biochemistry
Affiliation	RCASC
Title of the Proposal	
Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants	

Please provide a summary of the proposal highlighting strengths, weaknesses, scope for individual growth, and overall impact on organizational and societal development- for management review (max 150 words).

* Please find an attachment.

Signature of Panel Member: _____

Name of Panel Member: SANJAY PRASAD ***Date:*** 24/01/2020

Summary of the project

Title of the project: *Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants.*

Summary:

The project mainly focusses on the purification of waste water by usage of synthesized organic - inorganic hybrid polymers. The PIs have briefly explained the methods of synthesizing the polymers. The plan of the investigators is to make a band gap tunable complex so that it can be easily used to reduce the organic pollutants in the water by simple irradiation of visible light. They are trying to harness the advantages of the photocatalytic reactions. The synthesized polymers are expected to reduce the organic waste in the water by the production of reactive oxygen species under visible light.

The prepared material will be characterized by using various chemical methods like PXRD, SCXRD, UV-Vis Spec, IR, CV etc.

Research and Development Fund

Confidential report

(To be sent in sealed envelope to Honorable Chief Executive)

Name of the Principal Investigator	Dr. Asha K S
Department	Chemistry and Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Mr. Prasanna Kumar SG
Department	Chemistry and Biochemistry
Affiliation	RCASC
Title of the Proposal	
Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants	

Please provide a summary of the proposal highlighting strengths, weaknesses, scope for individual growth, and overall impact on organizational and societal development- for management review (max 150 words).

The current topic chosen by the PI is very much needed for the society. This is because the pollution, especially water pollution is the burning problem in almost all parts of the world. For this we have to appreciate the PI. Then PI has expertise in the MOF synthesis and studying their properties. However, the PI not convinced the dominant characters of the MOFs over other reported or existed photocatlysts for water pollution control. Numerous photocatalysts are coming into the market and exhibiting good photocatalytic properties for degradation studies. So, the PI should mention the difference of proposed materials in the proposal. With this, revision I think the project can be funded.

Signature of Panel Member: _____ Ramakrishnappa T

Name of Panel Member: Dr.Ramakrishnappa.T ***Date: 10-02-2020***

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	Through:	To:
The Principal RCASC	The Chief of Finance GEF (Engg & GS)	The Chief Executive GEF

Date: 17.03.20

Respected Sir,

As per your suggestions, we have revised the budget for the approved 6 proposals for seed money. The total estimated budet is Rs. 20.89 Lakhs (Rs. 15.89 for seed money + Rs. 5 Lakhs for Insfrastructure).

Kindly approve.

Dr. A. Nagarathna
Principal

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund

A total of 16 proposals have been submitted for review. 10 panel expert committee was arranged under respected CE sir supervision. After review, 6 proposals have met selection criteria and later presented their proposals to respected CE, CoF, and Principal. They are all requested to revise their budget in purview of availability of infrastructure present at sister Ramaiah institutes. Dean of Sciences coordinated all proceedings under the guidance of CE/Principal.

Details of revised budget is as below:

S.No	PI	Department	Requested Budget in lakhs	Revised budget lakhs
1	Dr. VinuthaGowda	Biotechnology	1.16	1.16
2	Dr. Vasanth K Bhaskara	Biochemistry	3.0	1.5
3	Dr. Krishna Rao J	Biochemistry	4.0	3.0
4	Dr. Nirmala Devi	Microbiology	4.5	3.1
5	Dr. Asha KS	Chemistry	5.5	3.26
6	Dr. VemulaVani	Microbiology	13.87	3.87
	Total		32.03	**15.89**

One year 2 Pub
Two year 1 publish
Two year 2 publish
Two year 2 publish
Two year 3 years
Three year 2 publication

The revised budget concentrates mainly on the consumables and outsourcing costs to pursue the projects over a period of 2 to 3 years.

In order to augment infrastructure development within RCASC, we kindly request management to provide with a budget of **5.0 lakhs** which will help us to procure UV Spectrophotometer, Gel Doc apparatus, and a PCR machine. These equipment will provide self-sustainability for research infrastructure at RCASC and assists in Research Center recognition process, in improving student dissertations, and allows other faculty members to pursue their preliminary work.

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Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Vinutha M
Department	Biotechnology& Genetics
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Akshatha KN
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Study and evaluation of Cymbopogon species on Methicillin Resistant Staphylococcus aureus (MSRA)	

Requested Budget

Sl. No	Item	BUDGET	Amount (In Rupees)
		1st Year	Total
1.	Equipment	Clavengers Sohxlet Distilled water plant	6875 36,618 10,500
2	Research Assistant		5000
4.	Travel		5000
5.	Other costs	Plant samples ATCC Culture TLC HPLC GCMS Sub total	2000 2500 17,250 15,000 15,000 51,750
	Grand total		**1,15,743/-**

This project also requires **UV Spectrophotometer**

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. VemulaVani
Department	Microbiology
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Nishitha KP
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Structure based design and functional evaluation of potential inhibitors against HPV E6 protein	

Sl. No	Item	BUDGET			Amount (In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	Equipment 1. Workstation for Bioinformatics software 2. Dicovery Studio software (Outsourcing) 3. Hot plate 4. Melting point apparatus 5. Tissue culture facilty	1,70,000 20,000	 3000 24,000		1,70,000 20,000 3000 24,000 10,00,000
2.	Consumables 1. Glassware 2. Chemicals		20,000 30,000	20,000 30,000	100,000
3	Travel	10000	10000	10000	30,000
4	Other costs Outsourcing of IR-NMR/GC-MS/XPS/XRD studies/SEM& TEM		40,000		40,000
	Grand total (requested)				**13,87,000/-**
	Grand total (revised)				**3,87,000/-**

RCASC does not have cell culture facility. So for the feasibility of the project the PI can access either facility at IISc or RMC.

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College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Vasanth K Bhaskara
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Vijaya V. Mysorekar
Department	Pathology
Affiliation	Ramaiah Medical College & Hospital
Title of the Proposal	
Molecular Characterization of cancer stem cell mediated drug resistance in Triple Negative Breast Cancer (TNBC)	

#	Item	BUDGET			Amount (In Rs.)
		1st Year	2nd Year	3rd Year	Total
1.	Equipment	1. Inverted Microscope 2. CO_2 incubator 3. Benchtop Centrifuge			1.5 LAKH
2.	Consumables	1. Culture Media 2. Trypsin 3. Pipettes, Petridishes, etc., 4. Antibodies 5. Chemical Reagents	1. Culture Media 2. Trypsin Pipettes, Petridishes, etc., 3. Chemical Reagents		1.25 LAKH
3.	Research Assistant	NIL	NIL		
4.	Travel	NIL	NIL		
5.	Other costs		Outsourcing samples for plate reader analysis for MTT assay, SRB assay, etc		25,000
	Grand total(requested)	2 Lakh	1 Lakh		**3 LAKH**
	Grand total (revised)				**1.5 lakhs**

This project requires cell culture facility which can be accessed at RMC. The PI has already made measure for a general MoU with RMC. Project specific MoU need to be generated.

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Nirmala Devi
Department	Microbiology
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Manjunath A S
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Control and detoxification of Mycotoxins in food and feed- A biological approach	

Sl. No	Item		BUDGET			Amount (In Rupees)
			1st Year	2nd Year	3rd Year	Total
1.	Equipment	Micropipettes	25,000			1,50,000 (40000)
		UV Cabinet	15,000			
		UV Spectrometer	1,10,000			
2.	Consumables	Glassware	60,000	20,000		80,000
		Chemicals	80,000	20,000		1,00,000
		Miscellaneous	15,000 (5000)	10,000 (0)	5,000	30,000 (10,000)
3	Other costs (Outsourcing)	HPLC analysis		30,000 (20,000)		90,000 (80,000)
		GC-MS analysis		30,000		
		PCR sequencing			30,000	
	Grand total					**4,50,000**
	Grand total					**3,10,000**

This project also requires UV Spectrophotometer. It also demands a safe lab space for pursuing contaminated food and feed samples, which can be availed at RCASC.

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Krishna Rao Jagarlamudi
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Nagagireesh Bojanala
Department	Biotechnology & Genetics
Affiliation	RCASC
Title of the Proposal	
Premature Ovarian Failure (POF) mutation detection by exome capture and next generation sequencing	

#	Item	BUDGET			Amount(In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	Consumables	DNA Isolation Kit & Enzymes Gloves, tips and appendorf tubes PCR Machine			70,000 20,000 1,10,000
2	Other costs	Outsourcing Samples for Exome Capture, Analysis, Publication etc			2,00,000
	Grand total				4,00,000
	Grand total Revised				3,00,000

This project also requires UV Spectrophotometer and PCR machine. Both can be accessed either at RIT or RMC. PI has already initiated communication in this regard.Exome sequencing facility is not available at Ramaiah Institutions, so it has to be outsourced.

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Asha K S
Department	Chemistry and Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Mr. Prasanna Kumar SG
Department	Chemistry and Biochemistry
Affiliation	RCASC
Title of the Proposal	
Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants	

Budget Presented

Sl. No	Item	BUDGET			Amount (In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	**Equipment** UV Spectrophotometer Oven with 250 ^{0}C Autoclave bomb (8)	 2.0 lakhs 1.6 lakh 40000	50,000	-	4.5 lakhs
2.	Consumables	30000.00	20000.00	20000.00	70000.00
3	Travel	NA	3000.00	3000.00	6000.00
4	Other costs	4000.00	3000.00	3000.00	10000.00
	Grand total	4.34 lakhs	76000.00	26000.00	**5.36 lakhs**

Revised Budget

Sl. No	Item	BUDGET			Amount (In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	**Equipment** UV Spectrophotometer Oven with 250 ^{0}C Autoclave bombs (8)	 2.0 lakhs 1.6 lakh 40000	 40000	-	2.4 lakhs
2.	Consumables	30000.00	20000.00	20000.00	70000.00
3	Travel	NA	3000.00	3000.00	6000.00
4	Other costs	4000.00	3000.00	3000.00	10000.00
				Grand total	**3.26 lakhs**

UV Spectrophotometeris not available at RCASC. So, this instrument can be accessed through RIT facility upon proper approval letters from management.

RAMAIAH
College of Arts, Science & Commerce

11-03-2020,
Bangalore.

Research and Development Meeting and Seed Money Grants

Proceedings of Minutes of Meeting held on 10/03/2020 & 11/03/2020

Purpose: Of the submitted 16 proposals for seed money, 6 received positive feedback from reviewers. The present meeting was planned to discuss the on the scoring, budgetary requirements, resources, and timeline on individual projects.

Coveners:

1) Honorable Chief Executive-GEF, B.S Ramaprasad IAS
2) HonorableCFO-GEF, G. Ramachandra
3) Principal, Dr.Nagarathna A
4) Dean of Sciences, Dr.Nagagireesh Bojanala

Summary:

1. Reviewer's feedback on individual proposals was updated to honourable Chief Executive and Chief of Finance
2. Principal Investigator (PI) presented their individual proposals to honourable Chief Executive and Chief of Finance in PowerPoint format
3. Each project was discussed in-depth on the outcomes, budget, and resources required for smoother completion of the projects
4. It was also specifically mentioned that available resources in terms of expertise and high-end infrastructure need to be utilized in an appropriate manner. Accordingly, all faculty are requested to revise their budget also
5. A maximum of 2 to 3 years was finalized was suggested by the faculty for the timely completion of the projects
6. All faculty are strongly encouraged to apply for external funding for their research based on the preliminary results obtained through seed money initiative

External reviewr scores on the project proposals:

#	Principal Investigator (PI)	Title of the proposal	External Reviewer Allotted	Affiliation	Final Review Received	Score Given (max 40)
1	**Dr. Krishna Rao J** Department of Biochemistry, RCASC	Premature Ovarian Failure (POF) mutation detection by exome capture and Next Generation Sequencing (NGS)	**Dr.Puttaraju** Professor, Dept. of Life & Biological Sciences	Bangalore University	20-02-2020	33
			Dr. Angel Beula Senior Clinical Scientist & Genetic Counsellor	Ramaiah Medical College & Hospital	25-02-2020	35
2	**Dr.Nirmala Devi** Department of Microbiology, RCASC	Control and detoxification of Mycotoxins in food and feed samples - A Biological approach.	**Dr.Puttaraju** Professor, Dept. of Life & Biological Sciences	Bangalore University	20-02-2020	31
			Dr.Manjunath Professor, Department of Microbiology & Biotechnology	Bangalore University	27-02-2020	33
3	**Dr.Vasanth K Bhaskara** Department of Biochemistry, RCASC	Molecular Characterization of Cancer Stem Cell Mediated Drug Resistance in Triple Negative Breast Cancer (TNBC)	**Dr. KNC Murthy** Chief Scientist, Central Research Laboratory	Ramaiah Medical College & Hospital	17-01-2020	26
			Dr.VanithaGowda Professor & HOD, Department of Biochemistry	Ramaiah Medical College	28-02-2020	34
4	**Dr.VemulaVani** Department of Microbiology, RCASC	Structure based design and functional evaluation of potential inhibitors against HPV E6 protein.	**Dr. KNC Murthy** Chief Scientist, Central Research Laboratory	Ramaiah Medical College & Hospital	17-01-2020	28
			Dr.VanithaGowda Professor & HOD, Department of Biochemistry	Ramaiah Medical College	28-02-2020	35

5	**Dr. Asha K S** Department of Chemistry, RCASC	Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants	**Dr.Ramakrishnappa T** Associate Professor &HoD, Department of Chemistry	BMSIT Bangalore	10-02-2020	35
			Dr. Sanjay Prasad Senior Scientific Officer, Inorganic and Physical Chemistry (IPC)	IISc, Bengaluru	02-03-2020	21
6	**Dr.Vinutha M** Department of Biotechnology, RCASC	Study and evaluation of *Cymbopogon*species on Methicillin Resistant *Staphylococcus aureus* (MRSA)	**Dr. KNC Murthy** Chief Scientist, Central Research Laboratory	Ramaiah Medical College & Hospital	17-01-2020	28
			Dr. Angel Beula Senior Clinical Scientist & Genetic Counsellor	Ramaiah Medical College & Hospital	25-02-2020	29

'A proposal that has scored between 25 to 35 marks was considered for presentation (score from 2 independent reviewers must cross 25)'

RAMAIAH
COLLEGE OF ARTS, SCIENCE & COMMERCE

DEPARTMENT OF CHEMISTRY & BIOCHEMISTRY

21st September 2020

To,
The Principal
RCASC, Bengaluru.

From,
Dr. Asha K S
Department of Chemistry & Biochemistry
RCASC, Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal

Dear Madam,

I, PI, Dr. Asha K S, Assistant Professor, and Co-PI, Prof. Prasanna Kumar S G, Associate Professor, belonging to Chemistry/Biochemistry Department have submitted the proposal entitled "*Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants*" for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.

As per the statement in our proposal, this project will be completed in the next 2 years (or 3 years) from the start day of the project (November 2020) provided the availability of equipment mentioned in the proposal as soon as possible.

We are happy to abide with the Terms & Conditions as mentioned by the institution.

Sincerely yours,

21/9/2020
Dr. Asha K S
(Principal Investigator)

Prof. Prasanna Kumar S G
(Co-PI)
21/09/2020

RAMAIAH COLLEGE OF ARTS, SCIENCE & COMMERCE

MSRIT Post, MSR Nagar, Bengaluru – 560 054

RCASC Funded Research Projects

Post Award Research Administration:

The Principal Investigator is responsible for conducting the project in accordance with the highest professional standards and for assuring that the project is executed as proposed in the application for funding. The PI is also responsible for adherence to College regulations as well as the terms and conditions of the award, assuring the appropriateness of expenditures, documenting that is required and submitting progress reports to the concerned authority as required by the terms of the award.

SL. NO.	PARTICULARS	DESCRIPTION	REMARKS
1	Approval	Before the start of the project, prior approval should be obtained from the competent authorities, if animals/ humans/ cell lines are used in the research work.	NA
2	Implementation of the project work	As per the goals/ objectives specified in the proposal and ensuring that the scope of work and deliverables are completed in a quality manner within the scheduled duration.	YES
3	Budget	The fund utilization must be accomplished within the specified budget and timeline and comply with the rules and regulations.	YES
4	Progress/Performance report	Quarterly report regarding the status of the project, in a specific format should be submitted through the HOD to the Head of Research and the Principal.	As per the progress the report may be submitted
5	Evaluation	The quarterly report should be presented before the Review committee and the suggestions to be implemented.	YES
6	Documentation	Maintaining a data system to collect appropriate data needed to document progress, report performance and evaluation of the project.	Data will be documented and maintained by myself

			and Co-PI
7	Reporting	If there are any deviations/untoward incident it should be immediately reported to the higher authorities or the investigator has to discontinue the work in middle, prior information should be given to the management and see that the smooth conduction of the work is continued.	YES
8	Submission of the project report	The final report (soft copy & hard copy) should be submitted through the HOD to the Head of Research and the Principal.	YES
9	Utilization certificate	The fund utilized should be audited from a chartered accountant and submitted along with the final project report.	YES
10	Project close out	The committee will review the reports to ensure compliance with all the grant terms and conditions as well as to make sure the funds was spent appropriately and confirm.	YES
11	Record Retention	The investigator is required to retain the financial and programmatic records, supporting documents, statistical records, and all other records that are required by the terms of a grant, or may reasonably be considered pertinent to a grant, for a period of 5 years from the date the final report submission.	YES
12	Paper presentation/ Publication/Inventions/Patent	Paper presentation can be done in the conferences/ seminars with due acknowledgement. A research paper should be published in a reputed journal with due acknowledgement. If there are any patent to be filed, it should be processed through the College IPR cell.	YES

Note: Investigators must ensure that prudent business decisions are made of the expenditure of funds, and must monitor Financial Conflicts of Interest, Nepotism, and Research Misconduct. Principal investigator and the co-investigator has to give an undertaking that in case of the exit

of any one of the person ,the other person should complete the project and submit the UC in the stipulated time, however failing to do so ,the amount sanctioned is going to be recovered from the person/s.

Principal

Dr. Asha K S.
(PI)
21/9/2020

S. G.
Prof. Prasanna Kumar SG
(Co-PI)

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	Dr. Vasanth K Bhaskara Asst. Professor, Dept of Chemistry/BC RCASC

Date: 24.09.2020

OFFICE ORDER

With reference your Seed Money Research Proposal budget, we are pleased to inform you that the seed money of ₹1.5 lakhs has been sanctioned by the Management for the Research Project.

You may start your project work immediately and inform the progress of the project from time to time to the undersigned.

Dr. A. Nagarathna
Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 56 0054

Received
24.09.20

RAMAIAH
College of Arts, Science & Commerce

DEPARTMENT OF CHEMISTRY & BIOCHEMISTRY

Date: 24th Sep., 2020

To,
The Principal,
RCASC,
Bengaluru.

From,
Vasanth K Bhaskara Ph.D,
Department of Chemistry & Biochemistry,
RCASC,
Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal

Dear Madam,

I, Dr. Vasanth K Bhaskara, Assistant Professor, belonging to Department of Chemistry & Biochemistry and Dr. Vijaya V Mysorekar, Department of Pathology, RMCH have submitted proposal entitled "Molecular Characterization of Cancer Stem Cell Mediated Drug Resistance in Triple Negative Breast Cancer (TNBC)" for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.

As per the statement in our proposal, this project will be completed in the next 2 years (or with minimum extensions justified in written accordingly) from the start day of the project (October, 2020 with the physical availability of students).

We are happy to abide with the Terms & Conditions as mentioned by the institution. We have also enclosed necessary ethical clearance approvals from the concerned authority. We are going to execute with drug resistance studies based on IHC protocol as mentioned in project and cell culture work cannot be of our priority as equipment fund has been cancelled.

Sincerely yours,

24.09.20

Vasanth K Bhaskara, Ph.D
Principal Investigator,
Department of Chemistry & Biochemistry,
RCASC,
Bengaluru.

Head of the Department
CHEMISTRY / BIO-CHEMISTRY
M.S. Ramaiah College of Arts,
Science & Commerce
Bangalore - 560 054

RAMAIAH
College of Arts, Science
& Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Vasanth K Bhaskara
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Vijaya V. Mysorekar
Department	Pathology
Affiliation	Ramaiah Medical College & Hospital
Title of the Proposal	
Molecular Characterization of cancer stem cell mediated drug resistance in Triple Negative Breast Cancer (TNBC)	

#	Item	BUDGET			Amount (In Rs.)
		1st Year	2nd Year	3rd Year	Total
1.	Equipment	1. Inverted Microscope 2. CO_2 incubator 3. Benchtop Centrifuge			1.5 LAKH
2.	Consumables	1. Culture Media 2. Trypsin 3. Pipettes, Petridishes, etc., 4. Antibodies 5. Chemical Reagents	1. Culture Media 2. Trypsin Pipettes, Petridishes, etc., 3. Chemical Reagents		1.25 LAKH
3.	Research Assistant	NIL	NIL		
4.	Travel	NIL	NIL		
5.	Other costs		Outsourcing samples for plate reader analysis for MTT assay, SRB assay, etc		25,000
	Grand total(requested)	2 Lakh	1 Lakh		**3 LAKH**
	Grand total (revised)				1.5 lakhs

This project requires cell culture facility which can be accessed at RMC. The PI has already made measure for a general MoU with RMC. Project specific MoU need to be generated.

M.S. RAMAIAH MEDICAL COLLEGE AND HOSPITALS

ETHICS COMMITTEE

MSR NAGAR, MSRIT POST, BANGALORE 560 054 INDIA

Tel: 080-23605190, 23601742, 23601743, 23605408 Fax: 080-23606213

E-mail : msr_medical@dataone.in, msrmedical@gmail.com web : www.msrmc.ac.in

Ref.No.

Reg. No. : ECR/215/Inst/Ker/2013

MSRMC/EC/2015

Date: 21/10/2015

To,

Dr. Vasantha Kumar Bhaskara,
Department of Biochemistry,
M. S. Ramaiah College of Arts Science and Commerce,
Bangalore - 560 054

Sub: "Molecular characterization of Triple Negative Breast Cancers (TNBC)."

****

The above mentioned Academic Protocol was placed before the Ethics Committee in the meeting held on 17th Oct, 2015 and the same was approved by the Ethics Committee.

(Dr. A. C. Ashok)

Member Secretary

MEMBER SECRETARY
For ETHICS COMMITTEE
M.S Ramaiah Medical College and Hospital
Bangalore-560 054

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	Dr. Krishna Rao Jagarlamudi Asst. Professor, Dept of Chemistry/BC RCASC

Date: 24.09.2020

OFFICE ORDER

With reference your Seed Money Research Proposal budget, we are pleased to inform you that the seed money of ₹2.90 lakhs has been sanctioned by the Management for the Research Project.

You may start your project work immediately and inform the progress of the project from time to time to the undersigned.

Dr. A. Nagarathna
Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 56 0054

24/9/20

RAMAIAH
College of Arts, Science & Commerce

Department of Chemistry/Biochemistry

Date: 23-09-2020
Bengaluru

To,
The Principal,
RCASC,
Bengaluru.

From,
Dr. Krishna Rao Jagarlamudi (PI)
Department Chemistry/Biochemistry
RCASC,
Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal

Dear Madam,

I, Dr. Krishna Rao Jagarlamudi, Assistant Professor belonging to Department of Chemistry/Biochemistry and Dr. Nagagireesh Bojanala, Dean, Head of Research, RCASC along with Co-PIs (Dr. Sujani BK, HOD, Dept. Of Obstetrics and Gynecology, RMCH) and (Dr. KNC Murthy, Principle Scientist, CRL, RMCH) from Ramaiah Medical college and Hospital (RMCH) have submitted proposal entitled' **Premature Ovarian Failure (POF) mutation detection by exome capture and Next Generation Sequencing** for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.

As per the statement in our proposal, this project will be completed in the next 2 years from the start day of the project. We are ready to start project from November 1st, 2020

We are happy to abide with the Terms & Conditions as mentioned by the institution. We have also enclosed necessary ethical clearance approvals from the concerned

Sincerely yours,

J. Krishna 23/9/20

PI: Dr. Krishna Rao Jagarlamudi

B. Nagagireesh 23/9/2020

Co-PI: Dr. Nagagireesh Bojanala

RAMAIAH COLLEGE OF ARTS, SCIENCE & COMMERCE

MSRIT Post, MSR Nagar, Bengaluru – 560 054

RCASC Funded Research Projects

Post Award Research Administration:

The Principal Investigator is responsible for conducting the project in accordance with the highest professional standards and for assuring that the project is executed as proposed in the application for funding. The PI is also responsible for adherence to College regulations as well as the terms and conditions of the award, assuring the appropriateness of expenditures, documenting that is required and submitting progress reports to the concerned authority as required by the terms of the award.

SL. NO.	PARTICULARS	DESCRIPTION	REMARKS
1	Approval	Before the start of the project, prior approval should be obtained from the competent authorities, if animals/ humans/ cell lines are used in the research work.	Submitted all documents to Ethical Committee, RMCH and application under Review. Hoping to get clearance by October 15th, 2020
2	Implementation of the project work	As per the goals/ objectives specified in the proposal and ensuring that the scope of work and deliverables are completed in a quality manner within the scheduled duration.	Yes, 2 years
3	Budget	The fund utilization must be accomplished within the specified budget and timeline and comply with the rules and regulations.	Yes, I agree
4	Progress/Performance report	Quarterly report regarding the status of the project, in a specific format should be submitted through the HOD to the Head of Research and the Principal.	As per project progression I will update/Submit accordingly to respective

			higher authorities
5	Evaluation	The quarterly report should be presented before the Review committee and the suggestions to be implemented.	Yes I agree
6	Documentation	Maintaining a data system to collect appropriate data needed to document progress, report performance and evaluation of the project.	I will save and document all results as per publication criteria
7	Reporting	If there are any deviations/untoward incident it should be immediately reported to the higher authorities or the investigator has to discontinue the work in middle, prior information should be given to the management and see that the smooth conduction of the work is continued.	I agree
8	Submission of the project report	The final report (soft copy & hard copy) should be submitted through the HOD to the Head of Research and the Principal.	Yes I agree
9	Utilization certificate	The fund utilized should be audited from a chartered accountant and submitted along with the final project report.	Yes I agree
10	Project close out	The committee will review the reports to ensure compliance with all the grant terms and conditions as well as to make sure the funds was spent appropriately and confirm.	Yes I agree
11	Record Retention	The investigator is required to retain the financial and programmatic records, supporting documents, statistical records, and all other records that are required by the terms of a grant, or may reasonably be considered pertinent to a grant, for a period of 5 years from the date the final report submission.	Yes I agree

12	Paper presentation/ Publication/Inventions/Patent	Paper presentation can be done in the conferences/ seminars with due acknowledgement. A research paper should be published in a reputed journal with due acknowledgement. If there are any patent to be filed, it should be processed through the College IPR cell.	Yes I agree

Note: Investigators must ensure that prudent business decisions are made of the expenditure of funds, and must monitor Financial Conflicts of Interest, Nepotism, and Research Misconduct. Principal investigator and the co-investigator has to give an undertaking that in case of the exit of any one of the person ,the other person should complete the project and submit the UC in the stipulated time, however failing to do so ,the amount sanctioned is going to be recovered from the person/s.

Principal

RAMAIAH
College of Arts, Science
& Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Krishna Rao Jagarlamudi
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Nagagireesh Bojanala
Department	Biotechnology & Genetics
Affiliation	RCASC
Title of the Proposal	
Premature Ovarian Failure (POF) mutation detection by exome capture and next generation sequencing	

#	Item	BUDGET			Amount(In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	Consumables	DNA Isolation Kit & Enzymes Gloves, tips and appendorf tubes PCR Machine			70,000 20,000 1,10,000
2	Other costs	Outsourcing Samples for Exome Capture, Analysis, Publication etc			2,00,000
	Grand total				4,00,000
	Grand total revised				2,90,000

This project also requires UV Spectrophotometer and PCR machine. Both can be purchased through common Infrastructure augmentation fund. Exome sequencing facility is not available at Ramaiah Institutions, so it has to be outsourced.

J. Krho
23/9/20

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	The Chief Executive GEF Engg & GS

Date: 25.09.2020

Respected Sir,

With regard to the sanction of seed money for Research Projects, the following faculty members have submitted the declaration letter for the approved seed money proposal.

1. Dr. Asha K.S
2. Dr. Krishna Rao J
3. Dr. Vasanth K Bhaskara

Kindly approve the same and do the needful.

Dr. A. Nagarathna
Principal

We go ahead with other steps to be initiated to commence the work as early as applicable

Principal. 25/9/2020

Dean B. Nagaraja 28/09/20

Gmail

Principal Msrcasc <principal.msrcasc@gmail.com>

Sanction of Seed Money

1 message

Principal Msrcasc <principal.msrcasc@gmail.com> Thu, Sep 3, 2020 at 4:50 PM

To: Adhi sakthi <adhi_eng@msrcasc.edu.in>, Aditi arun rao <aditiarunrao.psy@gmail.com>, Dhanashri Vaishali <vdhanashri@gmail.com>, Dr Lakshmikanth R N <lakshmisandal@gmail.com>, Dr Vemula Vani <vemula.vani@gmail.com>, "Dr. A. Nagarathna" <dr.nagarathnaa@gmail.com>, "Dr. Amaranath" <amarnathsa@gmail.com>, "Dr. Anuradha Ramanna" <anuramanna.polsc@gmail.com>, "Dr. Aruna Kumari M L" <drarunakumariml@gmail.com>, "Dr. Asha K S" <asha.nair.ks@gmail.com>, "Dr. Ashok Kumar H G" <ashokame84@gmail.com>, "Dr. Chakrapani Gopal" <chakrapani0819.rcasc@gmail.com>, "Dr. Geetika Pant" <way2geetika@gmail.com>, "Dr. Harisha" <harish.ukkunda@gmail.com>, "Dr. Krishna Rao" <ankammachowdary1@gmail.com>, "Dr. M.Lakshmi Pathi Naidu" <mlpnaidu@gmail.com>, "Dr. M.Vidya" <mvidyalu@yahoo.co.in>, "Dr. Nagagireesh" <gireesh.bojanala@gmail.com>, "Dr. Nirmala Devi D" <nirmaladevi1012@gmail.com>, "Dr. Padmalochana" <lochana.rebello@gmail.com>, "Dr. Prathibha V Kalburgi" <prathibavk@gmail.com>, "Dr. Preeti Gupta" <preetijain27@gmail.com>, "Dr. Pushpa H" <ramesh.pushpa1@gmail.com>, "Dr. R. Prashanthi" <prashanthibt10@gmail.com>, "Dr. Radha Dayanidhi" <radha_varvan@yahoo.co.in>, "Dr. Rashmi Nagesh" <rashmi.nagesh1689@gmail.com>, "Dr. Santosh Anand" <sanand.biotech@gmail.com>, "Dr. Satya Suresh" <ss.manuscript@gmail.com>, "Dr. Vasantha Kumara Bhaskar" <vasanthkbhaskara@gmail.com>, "Dr. Vibha Vinayakumar Bhat" <vibhamadhava@gmail.com>, "Dr. Vijay Kumar Reddy" <profvkreddy.vkreddy@yahoo.com>, "Dr. Vinutha M" <vinutha_gowda@yahoo.co.in>, "Dr.Bindu Nambiar" <deanmgtrcasc@gmail.com>, "Dr.Channarayappa" <channarayappa@gmail.com>, "Jayashree D.R" <jayashreedr2012@gmail.com>, Kishan <kishan.jour@gmail.com>, malathi palani <malathipalani@gmail.com>, Mr Lakshmi Pathi V <lakshmipathi_cs@msrcasc.edu.in>, Mr Prasanna Kumar <prasannakumar.chem@gmail.com>, Mr Ramakrishnaiah T N <ramakrishnaiahtn@gmail.com>, Mr Ravindranath <ravi.rayapur@gmail.com>, "Mr Surendra A.S" <suri.jain@gmail.com>, "Mr. Ajay Krishna" <ajaykrishna1994@gmail.com>, "Mr. Jayanth H" <jayanthhanumanthaiah@gmail.com>, "Mr. K.R Dasegowda" <dasegowda@gmail.com>, "Mr. Manjunath A.S" <manjunathronur@gmail.com>, "Mr. Naveen Kumar M" <naveenbio10@gmail.com>, "Mr. Prasanna Srinivas R" <microprasanna@gmail.com>, "Mr. Raju N" <rajunnayaka64@gmail.com>, "Mr. S. Prakash Nimbalkar" <prakashnimbal@gmail.com>, "Mr. Shankar Guddad" <sgbgk31@gmail.com>, "Mrs Dr. Shobha L" <shobhamsrcac@gmail.com>, Mrs Karanam Kavitha <karanam.kavitha@gmail.com>, Mrs Malini M R <malini_chem@msrcasc.edu.in>, "Mrs Padmaja M.R" <padmaja.mandyam@gmail.com>, "Mrs. Haritha A" <harithaehs@gmail.com>, "Mrs. Roopa H.S" <hsroopa26@gmail.com>, "Mrs.Ashwini ramesh" <msrcasc.mb.bt@gmail.com>, Ms Suma C <sumac236@gmail.com>, "Ms. Monica R" <monuraj930@gmail.com>, "Ms. Neha" <nehasangram0@gmail.com>, "Ms. Prabhavathi J" <jprabha.89@gmail.com>, "Ms. Prarthan Subbaiah N" <prarthan2@gmail.com>, "Ms. R. Muthusivagami" <r.muthusivagami@gmail.com>, "Ms. Rachana D" <rachanad.babu@gmail.com>, "Ms. Roopashree B.N" <roopashreebn1990@gmail.com>, "Ms. Sindhuja A" <sindhuja28@gmail.com>, "Ms. Soumya Shanbhag" <soum_sss@yahoo.co.in>, "Ms. Sowbhagya R" <sowbhagyachandru@gmail.com>, "Ms. Thulasi M.B" <thulasi.mb@gmail.com>, "Ms. Usharani S R" <usharanisr.91@gmail.com>, "Ms. Veena Shankar Terdal" <neha.terdal@gmail.com>, "Ms.Lakshmi V" <contactlakshmimurugan@gmail.com>, "Ms.Sanjogita R" <sanjogita.ramesh@gmail.com>, "Ms.Savitha B H" <savisati@gmail.com>, NAVEEN KUMAR R <nkr.hsd@gmail.com>, priya murthy <haripriyamsc@gmail.com>, "Prof. B.S Jayarama" <jayaram.commerce@gmail.com>, R Srividya <srividyajanu12@gmail.com>, "Ramya Kumari B.S" <ramyarr24@yahoo.co.in>, Rohini jagadish <rohinijagadish.msrcasc@gmail.com>, savitha R <savitha.ranju@gmail.com>, Shailaja M <shailaja.psy@gmail.com>, Shruthi N <sparkleshruthin@gmail.com>, snehalatha <snehavsuma7@gmail.com>, Vijayalakshmi D <vijayalakshmibrg@gmail.com>

Dear All,

In continuation of our circular No PO/2018-19/66 dated 14.12.2018 regarding the submission of proposal for the seed money,
we are happy to inform you that the seed money has been sanctioned for the 6 projects out of 16 projects submitted. The faculty members whose projects have been approved will be intimated separately with the terms and conditions for utilizing the seed money.

--

Dr. A. Nagarathna
Principal
Ramaiah College of Arts, Science and Commerce
Bengaluru

RAMAIAH
College of Arts, Science
& Commerce

Ref: PO/ 2018-19/66

14.12.2018

CIRCULAR

This is to inform all the faculty members that it has been decided by the Management to give the **SEED MONEY** for the in-house projects by the departments.

In this regard, you may submit the project proposal properly framed to the undersigned to avail this facility. In case your project is approved, seed money will be released to do the project.

Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 56 0054

GOKULA EDUCATION FOUNDATION

MSR NAGAR, BANGALORE-560054.

Date: 19/08/2020

From: The Chief of Finance GEF (Engg. & GS).	To: The Chief Executive GEF (Engg. & GS).

Sub: - Research & Development Project Funding Scheme.

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In order to promote Research and Development activities among the staff in the field of pure science, it is proposed to extend funding from the College for Research Projects. This will provide a platform to faculties to publish quality research publication and also go for external funding from Government Agencies and Corporates.

Similar funding scheme has been introduced in MSRIT and there are good numbers of research activities are happening. The funding amount per project is limited Rs.5.00 lakhs in MSRIT.

The Principal and Dean (Research) of MSRCASC were asked to work on the above lines to frame the polices and they are working on this since December 2019. The College has called proposal from its faculties and sixteen proposals were shortlisted for evaluation by external experts. Out of this sixteen proposals the following six proposals were considered for funding based on merits and credentials of Investigator.

Sl. No	Research Project Name	Department	Principal Investigator	Co-Investigator	Funding Requirement (Rs. in lakhs)
1	Premature Ovarian Failure (POF) mutation detection by exome capture and next generation sequencing	Chemistry & Biotechnology	Dr. Krishna Rao Jagarlamudi, Assistant Professor	Dr. Nagagireesh Bojanala, Re search Head	2.90
2	Control and detoxification of Mycotoxins in food and feed – A biological approach	Microbiology	Dr. Nirmala Devi, Assistant Professor	Dr. Manjunath A S, Assistant Professor	3.10
3	Molecular Characterization of cancer stem cell medicated drug resistance in Triple negative Brest Cancer (TNBC)	Chemistry & Biotechnology	Dr. Vasanth K Bhaskara, Assistant Professor	Dr. Vijaya V Mysorekar, Professor, Dept. of Pathology Ramaiah Medical College & Hospital	1.50
4	Structure based design and functional evaluation of potential inhibitors against HPV E6 protein	Microbiology	Dr. Vemula Vani, Assistant Professor	Dr. Nishitha K P, Assistant Professor	3.87

2.....

Sl. No	Research Project Name	Department	Principal Investigator	Co-Investigator	Funding Requirement (Rs. in lakhs)
5	Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants	Chemistry & Biotechnology	Dr. Asha K S, Assistant Professor	Mr.Prasanna Kumar S G, Associate Professor	3.26
6	Study and evaluation of Cymbopogon species on Methicillin Resistant Staphylococcus aureus (MSRA)	Biotechnology & Genetics	Dr. Vinutha M, Assistant Professor	Dr. Akshatha K N, Assistant Professor	1.16
	Total				**15.79**

The total cost of funding for the above six project is Rs.15.79 lakhs and in addition to this, the common infrastructure cost estimated is at Rs.5.00 lakhs. Accordingly, the total expenditure proposed will Rs.20.79 lakhs.

Hence, the approval is requested for (i) introduction of Research & Development Funding Scheme in the college and also (ii) approval for Rs.20.79 lakhs towards funding for six research projects.

It may be noted that out of the said funding of Rs.20.79 lakhs an amount of Rs.11.41 lakhs will be towards purchase of equipments and development of infrastructure in the college.

For kind approval and orders.

Chief of Finance

Chief Executive

The Hon'ble Director-MSRCASC

The Hon'ble Director- MSRCASC

Principal

1) To issue detailed Circular for the Scheme

2) To issue sanction letter for 6 project

RAMAIAH
College of Arts, Science & Commerce

M S Ramaiah College of Arts, Science and Commerce
Re-accredited 'A' by NAAC, Permanently Affiliated to Bangalore Central University,
Approved by Government of Karnataka, Approved by AICTE, New Delhi,
Recognized by UGC under 2f & 12B of UGC act 1956

Ref No: PO/ CIR/ 2020-21/020

Date: 20-10-2020

Dr. Asha K S,
Assistant Professor, Department Chemistry,
RCASC.

Madam,

Sub: Approval of Seed Funding

I am glad to inform you that the RCASC seed funding proposal submitted by you has been approved after due evaluation. This project will be supported by internal funding from college. The terms and conditions of approval/sanction are as detailed below:

Project Title/Reference Number	PI	Co-PI(s)	Total Approved Cost (in rupees)	Time frame	
				From	To
Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants	Dr. Asha KS, Assistant Professor, Department of Chemistry, RCASC.	Prof. Prasanna Kumar SG, HOD, Department of Chemistry, RCASC	**3,26,000** Break-up Equipment 2,40,000 Consumables 70,000 Outsourcing 16,000	November 2020	November 2022

Standing Research Committee will interact with you to monitor progress and provide necessary support and guidance. It is my hope that you will achieve the objectives stated for the proposed research work within the time stipulated.

1. All the request for release of funds under the project should be sent to the Principal through the Head of Research, RCASC as and when required
2. In case, the Principal investigator leaves RCASC he/she shall handover all the resources And findings to the person identified by the Principal
3. In case, the project results in applying patent same shall be made in the joint name of RCASC

As RCASC has made a conscious decision to encourage research of international standard, I am sure you will also make every effort to successfully complete the deliverables of the project as per the tenure agreed.

Please sign the acknowledgement/consent letter submitted to you and forward the same to the Head of Research, RCASC.

I wish you success in your research endeavours.

With my very best wishes

Received the Original
23/10/2020

Yours faithfully,

Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar

RAMAIAH
COLLEGE OF ARTS
SCIENCE & COMMERCE

DEPARTMENT OF CHEMISTRY & BIOCHEMISTRY

21st September 2020

To,
The Principal
RCASC, Bengaluru.

From,
Dr. Asha K S
Department of Chemistry & Biochemistry
RCASC, Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal

Dear Madam,

I, PI, Dr. Asha K S, Assistant Professor, and Co-PI, Prof. Prasanna Kumar S G, Associate Professor, belonging to Chemistry/Biochemistry Department have submitted the proposal entitled "*Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants*" for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.

As per the statement in our proposal, this project will be completed in the next 2 years (or 3 years) from the start day of the project (November 2020) provided the availability of equipment mentioned in the proposal as soon as possible.

We are happy to abide with the Terms & Conditions as mentioned by the institution.

Sincerely yours,

21/9/2020
Dr. Asha K S
(Principal Investigator)

Prof. Prasanna Kumar S G
(Co-PI)
21/09/2020

RAMAIAH
College of Arts, Science
& Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Asha K S
Department	Chemistry and Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Mr. Prasanna Kumar SG
Department	Chemistry and Biochemistry
Affiliation	RCASC
Title of the Proposal	
Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants	

Budget Presented

Sl. No	Item	BUDGET			Amount (In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	**Equipment** UV Spectrophotometer Oven with 250 ^{0}C Autoclave bomb (8)	 2.0 lakhs 1.6 lakh 40000	50,000	-	4.5 lakhs
2.	Consumables	30000.00	20000.00	20000.00	70000.00
3	Travel	NA	3000.00	3000.00	6000.00
4	Other costs	4000.00	3000.00	3000.00	10000.00
	Grand total	4.34 lakhs	76000.00	26000.00	5.36 lakhs

Revised Budget

Sl. No	Item	BUDGET			Amount (In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	**Equipment** UV Spectrophotometer Oven with 250 ^{0}C Autoclave bombs (8)	 2.0 lakhs 1.6 lakh 40000	 40000	-	2.4 lakhs
2.	Consumables	30000.00	20000.00	20000.00	70000.00
3	Travel	NA	3000.00	3000.00	6000.00
4	Other costs	4000.00	3000.00	3000.00	10000.00
				Grand total	**3.26 lakhs**

UV Spectrophotometer is not available at RCASC.

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College of Arts, Science & Commerce

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Re-accredited 'A' by NAAC. Permanently Affiliated to Bengaluru Central University
Approved by Government of Karnataka. Approved by AICTE, New Delhi.
Recognized by UGC under 2F & 12B of UGC act 1956

Ref No: PO/ CIR/ 2020-21/016

Date: 20-10-2020

To,
Dr. Krishna Rao Jagarlamudi,
Assistant Professor, Department of Biochemistry,
RCASC.

Sir,

Sub: Approval of Seed Funding

I am glad to inform you that the RCASC seed funding proposal submitted by you has been approved after due evaluation. This project will be supported by internal funding from college. The terms and conditions of approval/sanction are as detailed below:

Project Title/Reference Number	PI	Co-PI(s)	Total Approved Cost (in rupees)	Time frame	
				From	To
Premature Ovarian Failure (POF) mutation detection by exome capture and next generation sequencing	Dr. Krishna Rao J, Assistant Professor, RCASC.	Dr. Nagagireesh Bojanala, Dean of Sciences, RCASC.	**2,90,000** Break-up Equipment 25,000 Consumables 65,000 Consultancy 2,00,000	November 2020	November 2022

Standing Research Committee will interact with you to monitor progress and provide necessary support and guidance. It is my hope that you will achieve the objectives stated for the proposed research work within the time stipulated.

1. All the request for release of funds under the project should be sent to the Principal through the Head of Research, RCASC as and when required
2. In case, the Principal investigator leaves RCASC he/she shall handover all the resources And findings to the person identified by the Principal
3. In case, the project results in applying patent same shall be made in the joint name of RCASC

As RCASC has made a conscious decision to encourage research of international standard, I am sure you will also make every effort to successfully complete the deliverables of the project as per the tenure agreed.
Please sign the acknowledgement/consent letter submitted to you and forward the same to the Head of Research, RCASC.

I wish you success in your research endeavours.

With my very best wishes

Recieved original.
J. Krishna
23/10/2020

Yours faithfully,

Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 56 0054

RAMAIAH
College of Arts, Science & Commerce

Department of Chemistry/Biochemistry

Date: 23-09-2020
Bengaluru

To,
The Principal,
RCASC,
Bengaluru.

From,
Dr. Krishna Rao Jagarlamudi (PI)
Department Chemistry/Biochemistry
RCASC,
Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal

Dear Madam,

I, Dr. Krishna Rao Jagarlamudi, Assistant Professor belonging to Department of Chemistry/Biochemistry and Dr. Nagagireesh Bojanala, Dean, Head of Research, RCASC along with Co-PIs (Dr. Sujani BK, HOD, Dept. Of Obstetrics and Gynecology, RMCH) and (Dr. KNC Murthy, Principle Scientist, CRL, RMCH) from Ramaiah Medical college and Hospital (RMCH) have submitted proposal entitled' **Premature Ovarian Failure (POF) mutation detection by exome capture and Next Generation Sequencing** for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.

As per the statement in our proposal, this project will be completed in the next 2 years from the start day of the project. We are ready to start project from November 1st, 2020

We are happy to abide with the Terms & Conditions as mentioned by the institution. We have also enclosed necessary ethical clearance approvals from the concerned

Sincerely yours,

J. K Rao 23/9/20

PI: Dr. Krishna Rao Jagarlamudi

B. Nagagireesh 23/9/2020

Co-PI: Dr. Nagagireesh Bojanala

RAMAIAH
College of Arts, Science
& Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Krishna Rao Jagarlamudi
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Nagagireesh Bojanala
Department	Biotechnology & Genetics
Affiliation	RCASC
Title of the Proposal	
Premature Ovarian Failure (POF) mutation detection by exome capture and next generation sequencing	

#	Item	BUDGET			Amount(In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	Consumables	DNA Isolation Kit & Enzymes Gloves, tips and appendorf tubes PCR Machine			70,000 20,000 1,10,000
2	Other costs	Outsourcing Samples for Exome Capture, Analysis, Publication etc			2,00,000
	Grand total				4,00,000
	Grand total revised				2,90,000

This project also requires UV Spectrophotometer and PCR machine. Both can be purchased through common Infrastructure augmentation fund. Exome sequencing facility is not available at Ramaiah Institutions, so it has to be outsourced.

23/9/20

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	Dr. Vinutha M Asst. Professor, Dept of Biotechnology/ Genetics RCASC

Date: 28.09.2020

OFFICE ORDER

With reference your Seed Money Research Proposal budget, we are pleased to inform you that the seed money of ₹1.15 lakhs has been sanctioned by the Management for the Research Project.

You may start your project work immediately and inform the progress of the project from time to time to the undersigned.

Dr. A. Nagarathna

Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 56 0054

Recieved
Vinutha M.
30/09/2020

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	Dr. Nirmala Devi D Asst. Professor, Dept of Microbiology RCASC

Date: 28.09.2020

OFFICE ORDER

With reference your Seed Money Research Proposal budget, we are pleased to inform you that the seed money of ₹3.00 lakhs has been sanctioned by the Management for the Research Project.

You may start your project work immediately and inform the progress of the project from time to time to the undersigned.

Dr. A. Nagarathna
Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 56 0054

Received with Thanks
Nirmala Devi
28/9/20

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	Dr. Vemula Vani Asst. Professor, Dept of Microbiology RCASC

Date: 28.09.2020

OFFICE ORDER

With reference your Seed Money Research Proposal budget, we are pleased to inform you that the seed money of ₹3.87 lakhs has been sanctioned by the Management for the Research Project.

You may start your project work immediately and inform the progress of the project from time to time to the undersigned.

Dr. A. Nagarathna
Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 56 0054

Received with Thanks.
V. Vani
28/9/20

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	The Chief Executive GEF Engg & GS

Date: 25.09.2020

Respected Sir,

With regard to the sanction of seed money for Research Projects, the following faculty members have submitted the declaration letter for the approved seed money proposal.

1. Dr. Vinutha M
2. Dr. Vimula Vani
3. Dr. Nirmala Devi D

Kindly approve the same and do the needful.

Dr. A. Nagarathna
Principal

Pl. take further steps expeditiously so that the researches on Commons work are certified.

Thanks,

28/9/2020

RAMAIAH
College of Arts, Science & Commerce

BIOTECHNOLOGY AND GENETICS

To,
The Principal,
RCASC,
Bengaluru.

From,
Dr. Vinutha M.,
Department of Biotechnology and Genetics,
RCASC,
Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal.

Dear Madam,

I, Dr. Vinutha M., Assistant Professor, belonging to Department of Biotechnology and Genetics and Dr. Lakshmi Kanth. R. N. Assistant Professor, Department of Biotechnology and Genetics have submitted proposal entitled "Study and evaluation of *Cymbopogon* species on Methicillin Resistant *Staphylococcus aureus* (MRSA)" for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.

As per the statement in our proposal, this project will be completed in the next 2 years (or 3 years) from the start day of the project (01/11/2020), provided the necessary equipments, chemicals and students are available for the conduction of the project.

We are happy to abide with the Terms & Conditions as mentioned by the institution.

Sincerely yours,

Vinutha M. 25/9/20
Dr. Vinutha M.

Dr. Lakshmi Kanth. R. N.

RAMAIAH COLLEGE OF ARTS, SCIENCE & COMMERCE

MSRIT Post, MSR Nagar, Bengaluru – 560 054

RCASC Funded Research Projects

Post Award Research Administration:

The Principal Investigator is responsible for conducting the project in accordance with the highest professional standards and for assuring that the project is executed as proposed in the application for funding. The PI is also responsible for adherence to College regulations as well as the terms and conditions of the award, assuring the appropriateness of expenditures, documenting that is required and submitting progress reports to the concerned authority as required by the terms of the award.

SL. NO.	PARTICULARS	DESCRIPTION	REMARKS
1	Approval	Before the start of the project, prior approval should be obtained from the competent authorities, if animals/ humans/ cell lines are used in the research work.	NA
2	Implementation of the project work	As per the goals/ objectives specified in the proposal and ensuring that the scope of work and deliverables are completed in a quality manner within the scheduled duration.	Yes
3	Budget	The fund utilization must be accomplished within the specified budget and timeline and comply with the rules and regulations.	Yes
4	Progress/Performance report	Quarterly report regarding the status of the project, in a specific format should be submitted through the HOD to the Head of Research and the Principal.	The experiments designed may take more than three months to complete, hence, I request you to permit accordingly.
5	Evaluation	The quarterly report should be presented before the Review committee and the suggestions to be implemented.	Yes
6	Documentation	Maintaining a data system to collect appropriate data needed to	Yes

		document progress, report performance and evaluation of the project.	
7	Reporting	If there are any deviations/untoward incident it should be immediately reported to the higher authorities or the investigator has to discontinue the work in middle, prior information should be given to the management and see that the smooth conduction of the work is continued.	Yes
8	Submission of the project report	The final report (soft copy & hard copy) should be submitted through the HOD to the Head of Research and the Principal.	Yes
9	Utilization certificate	The fund utilized should be audited from a chartered accountant and submitted along with the final project report.	Yes
10	Project close out	The committee will review the reports to ensure compliance with all the grant terms and conditions as well as to make sure the funds was spent appropriately and confirm.	Yes
11	Record Retention	The investigator is required to retain the financial and programmatic records, supporting documents, statistical records, and all other records that are required by the terms of a grant, or may reasonably be considered pertinent to a grant, for a period of 5 years from the date the final report submission.	Yes
12	Paper presentation/ Publication/Inventions/Patent	Paper presentation can be done in the conferences/ seminars with due acknowledgement. A research paper should be published in a reputed journal with due acknowledgement. If there are any patent to be filed, it should be processed through the College IPR cell.	Yes

Note: Investigators must ensure that prudent business decisions are made of the expenditure of funds, and must monitor Financial Conflicts of Interest, Nepotism, and Research Misconduct. Principal investigator and the co-investigator has to give an undertaking that in case of the exit of any one of the person ,the other person should complete the project and submit the UC in the stipulated time, however failing to do so ,the amount sanctioned is going to be recovered from the person/s.

Principal

RAMAIAH
College of Arts, Science
& Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Vinutha M
Department	Biotechnology& Genetics
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Lakshmikanth RN
Department	Biotechnology& Genetics
Affiliation	RCASC
Title of the Proposal	
Study and evaluation of Cymbopogon species on Methicillin Resistant Staphylococcus aureus (MSRA)	

Requested Budget

Sl. No	Item	BUDGET	Amount (In Rupees)
		1st Year	Total
1.	Equipment	Clavengers Sohxlet Distilled water plant	6875 36,618 10,500
2	Research Assistant		5000
4.	Travel		5000
5.	Other costs	Plant samples ATCC Culture TLC HPLC GCMS Sub total	2000 2500 17,250 15,000 15,000 51,750
	Grand total		**1,15,743/-**

This project also requires **UV Spectrophotometer**

From

Dr. Vemula Vani
Assistant Professor
Department of Microbiology
Ramaiah college of Arts, Science and Commerce
Bengaluru

Through

The Proper Channel

To
The Principal
Ramaiah college of Arts, Science and Commerce
Bengaluru

Sub: Change of Co- Investigator for the seed money project- reg.

Dear Madam,

As one of the Co- investigators proposed for the seed money project titled "Structure based design and functional evaluation of potential inhibitors against HPV E6 protein" has left the institution i.e RCASC, I would like to include Dr. Amarnath Satheesh, Assistant Professor, Department of Biochemistry as the Co- Investigator. This is to bring to your kind notice and approval.

Thanking you,

Sincerely,

V. Vani 25/09/'20

Dr. Vemula Vani

Name and signature of Principal Investigator

A. Satheesh

Dr. Amarnath Satheesh

Name and signature of Co- Investigator

Shilpa. H 25/9/20.

S. G. Prof 25/9/20

B. Nagaghan 25/9/2020

RAMAIAH
College of Arts, Science & Commerce

DEPARTMENT OF MICROBIOLOGY

To,
The Principal,
RCASC,
Bengaluru.

From,
Dr Vemula Vani,
Department of Microbiology,
RCASC,
Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal

Dear Madam,

I, Dr. Vemula Vani, Assistant Professor, belonging to Department of Microbiology and Dr Amarnath Satheesh, Assistant Professor, belonging to the Department of Biochemistry have submitted proposal entitled "Structure based design and functional evaluation of potential inhibitors against HPV E6 protein" for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.

As per the statement in our proposal, this project will be completed in the next 3 years from the start day of the project (01.11.2020).

We are happy to abide with the Terms & Conditions as mentioned by the institution.

Sincerely yours,

V. Vani 25/9/20

Dr. Vemula Vani

Name and signature of Principal Investigator

A. Amarnath

Dr. Amarnath Satheesh

Name and signature of Co- Investigator

Copy to:

1. HOD, Dept. of Microbiology
2. HOD, Dept. of Biochemistry
3. Head of Research

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Vemula Vani
Department	Microbiology
Affiliation	RCASC
Name of the Co-Principal Investigator	Sanjay Prasad[1], Dr. Amarnath Satheesh[2],
Department	[1]Inorganic and physical chemistry, [2]Biochemistry
Affiliation	[1]IISc,[2]RCASC
Title of the Proposal	
Structure based design and functional evaluation of potential inhibitors against HPV E6 protein	

Sl. No	Item	BUDGET			Amount (In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	Equipment 1. Workstation for Bioinformatics software 2. Discovery Studio software (Outsourcing) 3. Hot plate 4. Melting point apparatus 5. Tissue culture facility	1,70,000 20,000	 3000 24,000		1,70,000 20,000 3000 24,000 10,00,000
2.	Consumables 1. Glassware 2. Chemicals		20,000 30,000	20,000 30,000	100,000
3	Travel	10000	10000	10000	30,000
4	Other costs Outsourcing of IR-NMR/GC-MS/XPS/XRD studies/SEM& TEM		40,000		40,000
	Grand total (requested)				**13,87,000/-**
	Grand total (revised)				**3,87,000/-**

RCASC does not have cell culture facility. So for the feasibility of the project the PI can access either facility at IISc or RMC.

RAMAIAH COLLEGE OF ARTS, SCIENCE & COMMERCE

MSRIT Post, MSR Nagar, Bengaluru – 560 054

RCASC Funded Research Projects

Post Award Research Administration:

The Principal Investigator is responsible for conducting the project in accordance with the highest professional standards and for assuring that the project is executed as proposed in the application for funding. The PI is also responsible for adherence to College regulations as well as the terms and conditions of the award, assuring the appropriateness of expenditures, documenting that is required and submitting progress reports to the concerned authority as required by the terms of the award.

SL. NO.	PARTICULARS	DESCRIPTION	REMARKS
1	Approval	Before the start of the project, prior approval should be obtained from the competent authorities, if animals/ humans/ cell lines are used in the research work.	**Cell lines are used in the study that do not require ethical committee approval**
2	Implementation of the project work	As per the goals/ objectives specified in the proposal and ensuring that the scope of work and deliverables are completed in a quality manner within the scheduled duration.	Yes
3	Budget	The fund utilization must be accomplished within the specified budget and timeline and comply with the rules and regulations.	Yes
4	Progress/Performance report	Quarterly report regarding the status of the project, in a specific format should be submitted through the HOD to the Head of Research and the Principal.	Progress report will be submitted as per the status of the project
5	Evaluation	The quarterly report should be presented before the Review committee and the suggestions to be implemented.	Yes
6	Documentation	Maintaining a data system to collect appropriate data needed to document progress, report performance and evaluation of the	Yes

Note: Investigators must ensure that prudent business decisions are made of the expenditure of funds, and must monitor Financial Conflicts of Interest, Nepotism, and Research Misconduct. Principal investigator and the co-investigator has to give an undertaking that in case of the exit of any one of the person ,the other person should complete the project and submit the UC in the stipulated time, however failing to do so ,the amount sanctioned is going to be recovered from the person/s.

Principal

RAMAIAH
College of Arts, Science & Commerce

DEPARTMENT OF MICROBIOLOGY

25. 09. 2020

To,
The Principal,
RCASC,
Bengaluru.

From,
Dr. Nirmala Devi. D,
Department of Microbiology,
RCASC,
Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal.

Dear Madam,

I, Dr. Nirmala Devi. D, Assistant Professor, Department of Microbiology and Dr. Manjunatha. A. S, Assistant Professor, Department of Microbiology, have submitted the proposal entitled "Control and detoxification of Mycotoxins in food and feed- A biological approach" for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.

As per the statement in our proposal, this project will be completed in the next 3 years from the start day of the project (01. 11. 2020).

We are happy to abide with the Terms & Conditions as mentioned by the institution.

Yours Sincerely,

Nirmala Devi 25/9/2020
PI: Dr. Nirmala Devi. D

A.S.M 25/09/2020
Co-PI: Dr. Manjunatha. A. S

Copy to HOD
Copy to Head of Research

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Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Nirmala Devi
Department	Microbiology
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Manjunath A S
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Control and detoxification of Mycotoxins in food and feed- A biological approach	

Sl. No	Item		BUDGET			Amount (In Rupees)
			1st Year	2nd Year	3rd Year	Total
1.	Equipment	Micropipettes	25,000			1,50,000 (40000)
		UV Cabinet	15,000			
		UV Spectrometer	1,10,000			
2.	Consumables	Glassware	60,000	20,000		80,000
		Chemicals	80,000	20,000		1,00,000
		Miscellaneous	15,000 (5000)	10,000 (0)	5,000	30,000 (10,000)
3	Other costs (Outsourcing)	HPLC analysis		30,000 (20,000)		90,000 (80,000)
		GC-MS analysis		30,000		
		PCR sequencing			30,000	
	Grand total					**4,50,000**
	Grand total revised					**3,10,000**

This project also requires UV Spectrophotometer. It also demands a safe lab space for pursuing contaminated food and feed samples, which can be availed at RCASC.

RAMAIAH COLLEGE OF ARTS, SCIENCE & COMMERCE

MSRIT Post, MSR Nagar, Bengaluru – 560 054

RCASC Funded Research Projects

Post Award Research Administration:

The Principal Investigator is responsible for conducting the project in accordance with the highest professional standards and for assuring that the project is executed as proposed in the application for funding. The PI is also responsible for adherence to College regulations as well as the terms and conditions of the award, assuring the appropriateness of expenditures, documenting that is required and submitting progress reports to the concerned authority as required by the terms of the award.

SL. NO.	PARTICULARS	DESCRIPTION	REMARKS
1	Approval	Before the start of the project, prior approval should be obtained from the competent authorities, if animals/ humans/ cell lines are used in the research work.	Animals/ humans/ cell lines will not be used in the project.
2	Implementation of the project work	As per the goals/ objectives specified in the proposal and ensuring that the scope of work and deliverables are completed in a quality manner within the scheduled duration.	Yes
3	Budget	The fund utilization must be accomplished within the specified budget and timeline and comply with the rules and regulations.	Yes
4	Progress/Performance report	Quarterly report regarding the status of the project, in a specific format should be submitted through the HOD to the Head of Research and the Principal.	Progress report will be submitted as per the status of the project
5	Evaluation	The quarterly report should be presented before the Review committee and the suggestions to be implemented.	Yes
6	Documentation	Maintaining a data system to collect appropriate data needed to document progress, report performance and evaluation of the	Yes

Note: Investigators must ensure that prudent business decisions are made of the expenditure of funds, and must monitor Financial Conflicts of Interest, Nepotism, and Research Misconduct. Principal investigator and the co-investigator has to give an undertaking that in case of the exit of any one of the person ,the other person should complete the project and submit the UC in the stipulated time, however failing to do so ,the amount sanctioned is going to be recovered from the person/s.

Principal

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	Dr. Asha K.S Asst. Professor, Dept of Chemistry/BC RCASC

Date: 24.09.2020

OFFICE ORDER

With reference your Seed Money Research Proposal budget, we are pleased to inform you that the seed money of ₹3.26 lakhs has been sanctioned by the Management for the Research Project.

You may start your project work immediately and inform the progress of the project from time to time to the undersigned.

Dr. A. Nagarathna
Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 56 0054

Received.
26/09/2020.
Dr. Asha K.S.

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College of Arts, Science & Commerce

Seed Money Research Project – Work Plan

Date: 12/11/2020

1) Principal Investigator (PI): Dr. Asha K S

Designation: Assistant Professor, Department of Chemistry

2) Co-Principal Investigator (Co-PI): Prof. Prasanna Kumar S. G.

Designation: Associate Professor & Head, Department of Chemistry

3) Funding approval Date: 20/10/2020

4) Title of the Project: Synthesis of photo catalytic metal organic coordination polymers and their application towards the decomposition of organic pollutants and sensing and separation of cis-diol compounds.

5) Proposed Work Plan:

5.1 Duration: 6 months (01/11/2020 to 31/05/2020)

5.2 Specific aims to be addressed: In the first phase of the project, we are planning to start with the synthesis of MOF (Metal-Organic Frameworks) material and their primary characterisation. Later on, the modification of the structure and properties of the MOF material may be done. The synthesis of Zirconium based Metal Organic frameworks since they are water stable, is planned and thereafter boronic acid will be grafted to the framework, such boronic acid decorated MOFs will be used in sensing and separation of cis-diols. The samples shall be sent out for PXRD and IR analysis. The optical and sensing studies are planned to be performed by using UV-visible spectrophotometer available at research centre, RCASC.

5.3 Experimental Plan: It includes the synthesis of Zirconium based Metal Organic Frameworks and their characterization.

5.4 Student Participation (if any): We plan to take 2 students (BSc or MSc) in the first phase of this project which mainly focus upon the synthesis of Metal Organic Frameworks.

5.5 Consumables and Infrastructure:

List of Chemicals required

1. Trimesic acid (Benzenetricarboxylic acid) - (Merck/Sigma/TCI chemicals) – 100 g
2. Terephthalic acid (1.4-benzenedicarboxylic acid) - (Merck/Sigma/TCI chemicals) – 100 g

3. Zirconium tetrachloride ($ZrCl_4$) or Zirconium oxychloride ($ZrOCl_2.xH_2O$) - (Merck/Sigma/TCI chemicals) – 25 g
4. N, N'-Dimethylformamide (DMF) (Solvent) – (Merck/Sigma) – 2 Litre
5. 4-carboxyphenylboronic acid - (Merck/Sigma/TCI chemicals) – 5 to 10 g
6. Acetone (solvent) - 500 mL
7. Ethanol (solvent) – 1 litre
8. Distilled water – 5 litres

List of Equipment required

1. UV-Visible Spectrophotometer (Double beam) – (Available at research lab, RCASC)
2. Teflon lined autoclave (Sealing type – threaded type) – 25 and 50 mL or two 25 mL
3. Sonicator – Ultrasonic bath – medium size
4. Mortar and Pestle – Agate – 2.5 inch inner diameter minimum
5. Oven (min 250 ^{0}C) – programmable
6. Tarsons micro centrifuge tube – 1.5 mL or 2 mL (1 packet)

5.6 Progress status (if any):

One review which is based on a comparative study between metal organic frameworks and covalent organic frameworks is under progress. The abstract has been submitted and is under review.

12/11/2020

Dr. Asha K.S.

RAMAIAH
College of Arts, Science
& Commerce

Seed Money Research Project – Work Plan

Date:12/11/2020

1) Principal Investigator (PI): Dr. Vinutha M.

Designation: Assistant Professor, Dept. of Biotechnology and Genetics, RCASC.

2) Co-Principal Investigator (Co-PI): Dr. LakshmiKanth R.N.

Designation: Assistant Professor, Dept. of Biotechnology and Genetics, RCASC.

3) Funding approval Date: 20-10-2020

4) Title of the Project:"Study and evaluation of *Cymbopogon*species on Methicillin Resistant *Staphylococcus aureus* (MRSA)"

5)Proposed Work Plan:

5.1 Duration: 6 months(Start to End dates) – 01/12/2020 to 01/05/2021.

5.2 Specific aims to be addressed: Extraction of Essential oil and Extraction of Plant extract.

5.3 Experimental Plan:

1. Lab setup.
2. Procurement of chemicals and instruments.
3. Collection of plant samples.
4. Extraction of essential oil.
5. Extraction of plant extract.

5.4 Student Participation (if any): 2 Students from M.Sc / B.Sc – Biotechnology, Chemistry, Microbiology.

5.5 Consumables and Infrastructure:

Sl. No	Proposed Plan of Action	Requirements
1	**Lab setup**	
2	**Procurement of Instruments**	a) Distillation Unit X1 no
		b) Clevenger`s apparatus X1 no
3	**Procurement of Consumables**	
(A)	**Chemicals**	Muller-Hinton Agar – 10 no
		Muller-Hinton broth – 10 no

		Mannitol salt agar – 10 no
		Triptic soya broth (TSB) – 10 no
		Blood agar – 10 no
		Nutrient Agar – 5 no
		Nutrient broth – 5 no
		Anhydrous Sodium sulphate - 100g
		Peptone – 100g X 3
		Beef extract – 100gX3
		Nacl – 500gX1
		Agar Agar – 500g X4
		Antibiotic discs –Methicillin X 4
		Penicillin X 4
		Oxacillin X 4
		Vancomycin X 4
		Ampicillin X 4
		Antibiotics – Methicillin – 100g X 1
		Penicillin - 100g X 1
		Oxacillin - 100g X 1
		Vancomycin - 100g X 1
		Ampicillin - 100g X 1
		Citral (Sigma Aldrich) – 100ml X 1
		Thimbles – 5no.
		Methanol – 250mlX4
		Ethanol - 100mlX10
		Acetone - 250ml X 2
		Glycerol - 250ml X 1
		Dimethyl Sulfoxide (DMSO) – 250ml X 1
		Spirit - 2 Lt
(B)	**Glasswares**	a) Petriplates – 60 nos
		b) Conical flasks – 100ml – 5 no
		250ml – 10 no
		500ml - 10 no.
		1000ml -10 no
		c) Testtubes – 75 no
		d) Pipettes – 1ml – 5 no
		5ml – 5 no
		10 ml – 5 no
		e) Micropipette - 10ul X 1
		f) Micropipette tips X 50
		g) Non absorbant cotton – 5 rolls

		h) Filter paper – 50 sheets
		i) Eppendoff tubes – 50 no.
		j) Spirit lamp – 2 no.
		k) Funnels – 4
		l) Beakers – 50ml – 10no
		100ml – 10no
		250ml - 10no
		500ml – 5 no
		1000ml – 5 no

Vinutha M.
30/11/2020

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	Dr. Nirmala Devi D Asst. Professor, Dept of Microbiology RCASC

Date: 28.09.2020

OFFICE ORDER

With reference your Seed Money Research Proposal budget, we are pleased to inform you that the seed money of ₹3.10 lakhs has been sanctioned by the Management for the Research Project.

You may start your project work immediately and inform the progress of the project from time to time to the undersigned.

Dr. A. Nagarathna
Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 560054

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	Dr. Krishna Rao Jagarlamudi Asst. Professor, Dept of Chemistry/BC RCASC

Date: 24.09.2020

OFFICE ORDER

With reference your Seed Money Research Proposal budget, we are pleased to inform you that the seed money of ₹2.90 lakhs has been sanctioned by the Management for the Research Project.

You may start your project work immediately and inform the progress of the project from time to time to the undersigned.

Dr. A. Nagarathna
Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 56 0054

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	Dr. Vasanth K Bhaskara Asst. Professor, Dept of Chemistry/BC RCASC

Date: 24.09.2020

OFFICE ORDER

With reference your Seed Money Research Proposal budget, we are pleased to inform you that the seed money of ₹1.5 lakhs has been sanctioned by the Management for the Research Project.

You may start your project work immediately and inform the progress of the project from time to time to the undersigned.

Dr. A. Nagarathna
Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 56 0054

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	Dr. Vinutha M Asst. Professor, Dept of Biotechnology/ Genetics RCASC

Date: 28.09.2020

OFFICE ORDER

With reference your Seed Money Research Proposal budget, we are pleased to inform you that the seed money of ₹1.15 lakhs has been sanctioned by the Management for the Research Project.

You may start your project work immediately and inform the progress of the project from time to time to the undersigned.

Dr. A. Nagarathna

Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 56 0054

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	Dr. Asha K.S Asst. Professor, Dept of Chemistry/BC RCASC

Date: 24.09.2020

OFFICE ORDER

With reference your Seed Money Research Proposal budget, we are pleased to inform you that the seed money of ₹3.26 lakhs has been sanctioned by the Management for the Research Project.

You may start your project work immediately and inform the progress of the project from time to time to the undersigned.

Dr. A. Nagarathna
Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 56 0054

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	To:
The Principal RCASC	Dr. Vemula Vani Asst. Professor, Dept of Microbiology RCASC

Date: 28.09.2020

OFFICE ORDER

With reference your Seed Money Research Proposal budget, we are pleased to inform you that the seed money of ₹3.87 lakhs has been sanctioned by the Management for the Research Project.

You may start your project work immediately and inform the progress of the project from time to time to the undersigned.

Dr. A. Nagarathna
Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore 56 0054

RAMAIAH
College of Arts, Science & Commerce

M S Ramaiah College of Arts, Science and Commerce
Re-accredited (3rd Cycle) by NAAC, Bengaluru | Affiliated to Bengaluru Central University
Approved by Government of Karnataka, Approved by AICTE, New Delhi
Recognized by UGC under 2F & 12B of UGC Act 1956

Ref No: PO/ CIR/ 2020-21/019

Date: 20-10-2020

To,
Dr. Vasanth Kumar Bhaskara,
Assistant Professor,
Department of Biochemistry,
RCASC.

Sir,

Sub: Approval of Seed Funding

I am glad to inform you that the RCASC seed funding proposal submitted by you has been approved after due evaluation. This project will be supported by internal funding from college. The terms and conditions of approval/sanction are as detailed below:

Project Title/Reference Number	PI	Co-PI(s)	Total Approved Cost (in rupees)	Time frame	
				From	To
Molecular Characterization of cancer stem cell mediated drug resistance in Triple Negative Breast Cancer (TNBC)	Dr. Vasanth KB, Assistant Professor, Department of Biochemistry, RCASC.	Dr. Vijaya Mysorekar, Professor & Head, Department of Pathology, RMC.	**1,50,000** Break-up Consumables 1,25,000 Outsourcing 25,000	November 2020	November 2022

Standing Research Committee will interact with you to monitor progress and provide necessary support and guidance. It is my hope that you will achieve the objectives stated for the proposed research work within the time stipulated.

1. All the request for release of funds under the project should be sent to the Principal through the Head of Research, RCASC as and when required
2. In case, the Principal investigator leaves RCASC he/she shall handover all the resources And findings to the person identified by the Principal
3. In case, the project results in applying patent same shall be made in the joint name of RCASC

As RCASC has made a conscious decision to encourage research of international standard, I am sure you will also make every effort to successfully complete the deliverables of the project as per the tenure agreed.

Please sign the acknowledgement/consent letter submitted to you and forward the same to the Head of Research, RCASC.

I wish you success in your research endeavours.

With my very best wishes

Received Original. Copy
23/10/2020

Yours faithfully,

Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSR Nagar

RAMAIAH
College of Arts, Science & Commerce

DEPARTMENT OF CHEMISTRY & BIOCHEMISTRY

Date: 24th Sep., 2020

To,
The Principal,
RCASC,
Bengaluru.

From,
Vasanth K Bhaskara Ph.D,
Department of Chemistry & Biochemistry,
RCASC,
Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal

Dear Madam,

I, Dr. Vasanth K Bhaskara, Assistant Professor, belonging to Department of Chemistry & Biochemistry and Dr. Vijaya V Mysorekar, Department of Pathology, RMCH have submitted proposal entitled "Molecular Characterization of Cancer Stem Cell Mediated Drug Resistance in Triple Negative Breast Cancer (TNBC)" for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.

As per the statement in our proposal, this project will be completed in the next 2 years (or with minimum extensions justified in written accordingly) from the start day of the project (October, 2020 with the physical availability of students).

We are happy to abide with the Terms & Conditions as mentioned by the institution. We have also enclosed necessary ethical clearance approvals from the concerned authority. We are going to execute with drug resistance studies based on IHC protocol as mentioned in project and cell culture work cannot be of our priority as equipment fund has been cancelled.

Sincerely yours,
24-09-20

Vasanth K Bhaskara, Ph.D
Principal Investigator,
Department of Chemistry & Biochemistry,
RCASC,
Bengaluru.

Head of the Department
CHEMISTRY / BIO-CHEMISTRY
M.S. Ramaiah College of Arts,
Science & Commerce
Bangalore - 560 054

RAMAIAH COLLEGE OF ARTS, SCIENCE & COMMERCE

MSRIT Post, MSR Nagar, Bengaluru – 560 054

RCASC Funded Research Projects

Post Award Research Administration:

The Principal Investigator is responsible for conducting the project in accordance with the highest professional standards and for assuring that the project is executed as proposed in the application for funding. The PI is also responsible for adherence to College regulations as well as the terms and conditions of the award, assuring the appropriateness of expenditures, documenting that is required and submitting progress reports to the concerned authority as required by the terms of the award.

SL. NO.	PARTICULARS	DESCRIPTION	REMARKS
1	Approval	Before the start of the project, prior approval should be obtained from the competent authorities, if animals/ humans/ cell lines are used in the research work.	Will be proceeded with earlier ethical clearance obtained
2	Implementation of the project work	As per the goals/ objectives specified in the proposal and ensuring that the scope of work and deliverables are completed in a quality manner within the scheduled duration.	IHC based analysis will be done
3	Budget	The fund utilization must be accomplished within the specified budget and timeline and comply with the rules and regulations.	For total 1.5 lakh
4	Progress/Performance report	Quarterly report regarding the status of the project, in a specific format should be submitted through the HOD to the Head of Research and the Principal.	Accepted
5	Evaluation	The quarterly report should be presented before the Review committee and the suggestions to be implemented.	Accepted
6	Documentation	Maintaining a data system to collect appropriate data needed to document progress, report performance and evaluation of the project.	Accepted
7	Reporting	If there are any deviations/untoward incident it should be immediately reported to the higher authorities or the investigator has to discontinue the work in middle, prior information should be given to the management and see that the smooth conduction of the work is continued.	Accepted

8	Submission of the project report	The final report (soft copy & hard copy) should be submitted through the HOD to the Head of Research and the Principal.	Accepted
9	Utilization certificate	The fund utilized should be audited from a chartered accountant and submitted along with the final project report.	Accepted
10	Project close out	The committee will review the reports to ensure compliance with all the grant terms and conditions as well as to make sure the funds was spent appropriately and confirm.	Accepted
11	Record Retention	The investigator is required to retain the financial and programmatic records, supporting documents, statistical records, and all other records that are required by the terms of a grant, or may reasonably be considered pertinent to a grant, for a period of 5 years from the date the final report submission.	Accepted
12	Paper presentation/ Publication/Inventions /Patent	Paper presentation can be done in the conferences/ seminars with due acknowledgement. A research paper should be published in a reputed journal with due acknowledgement. If there are any patent to be filed, it should be processed through the College IPR cell.	Accepted

Note: Investigators must ensure that prudent business decisions are made of the expenditure of funds, and must monitor Financial Conflicts of Interest, Nepotism, and Research Misconduct. Principal investigator and the co-investigator has to give an undertaking that in case of the exit of any one of the person ,the other person should complete the project and submit the UC in the stipulated time, however failing to do so ,the amount sanctioned is going to be recovered from the person/s.

24.09.20

PI: Dr. Vasanth K Bhaskara

Principal

RAMAIAH
College of Arts, Science
& Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Vasanth K Bhaskara
Department	Chemistry & Biochemistry
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Vijaya V. Mysorekar
Department	Pathology
Affiliation	Ramaiah Medical College & Hospital
Title of the Proposal	
Molecular Characterization of cancer stem cell mediated drug resistance in Triple Negative Breast Cancer (TNBC)	

#	Item	BUDGET			Amount (In Rs.)
		1st Year	2nd Year	3rd Year	Total
1.	Equipment	1. Inverted Microscope 2. CO_2 incubator 3. Benchtop Centrifuge			1.5 LAKH
2.	Consumables	1. Culture Media 2. Trypsin 3. Pipettes, Petridishes, etc., 4. Antibodies 5. Chemical Reagents	1. Culture Media 2. Trypsin Pipettes, Petridishes, etc., 3. Chemical Reagents		1.25 LAKH
3.	Research Assistant	NIL	NIL		
4.	Travel	NIL	NIL		
5.	Other costs		Outsourcing samples for plate reader analysis for MTT assay, SRB assay, etc		25,000
	Grand total(requested)	2 Lakh	1 Lakh		**3 LAKH**
	Grand total (revised)				1.5 lakhs

This project requires cell culture facility which can be accessed at RMC. The PI has already made measure for a general MoU with RMC. Project specific MoU need to be generated.

RAMAIAH
College of Arts, Science & Commerce

M S Ramaiah College of Arts, Science and Commerce
Re-accredited 'A' by NAAC, Permanently Affiliated to Bengaluru Central University,
Approved by Government of Karnataka, Approved by AICTE, New Delhi
Recognized by UGC under 2F & 12B of UGC act 1956

Ref No: PO/ CIR/ 2020-21/017

Date: 20-10-2020

To,
Dr. Vemula Vani,
Assistant Professor, Department of Microbiology,
RCASC.

Madam,

Sub: Approval of Seed Funding

I am glad to inform you that the RCASC seed funding proposal submitted by you has been approved after due evaluation. This project will be supported by internal funding from college. The terms and conditions of approval/sanction are as detailed below:

Project Title/Reference Number	PI	Co-PI(s)	Total Approved Cost (in rupees)	Time frame	
				From	To
Structure based design and functional evaluation of potential inhibitors against HPV E6 protein	Dr. Vemula Vani, Assistant Professor, Department of Microbiology, RCASC.	Dr. Amaranath Sateesh, Assistant Professor, Department of Biochemistry, RCASC. Dr. Sanjay Prasad, Scientific Officer, Department of IPC, IISc, Bengaluru.	**3,87,000** Break-up Equipment 27,000 Consumables 1,00,000 Outsourcing 70,000 Bioinformatics work station 1,70,000 Software, 20,000	November 2020	November 2022

Standing Research Committee will interact with you to monitor progress and provide necessary support and guidance. It is my hope that you will achieve the objectives stated for the proposed research work within the time stipulated.

1. All the request for release of funds under the project should be sent to the Principal through the Head of Research, RCASC as and when required
2. In case, the Principal investigator leaves RCASC he/she shall handover all the resources And findings to the person identified by the Principal
3. In case, the project results in applying patent same shall be made in the joint name of RCASC

As RCASC has made a conscious decision to encourage research of international standard, I am sure you will also make every effort to successfully complete the deliverables of the project as per the tenure agreed.

Please sign the acknowledgement/consent letter submitted to you and forward the same to the Head of Research, RCASC.

I wish you success in your research endeavours.

With my very best wishes

Received Personally
V. Vani
23/10/'20

Yours faithfully,

Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar

From

Dr. Vemula Vani
Assistant Professor
Department of Microbiology
Ramaiah college of Arts, Science and Commerce
Bengaluru

Through

The Proper Channel

To
The Principal
Ramaiah college of Arts, Science and Commerce
Bengaluru

Sub: Change of Co- Investigator for the seed money project- reg.

Dear Madam,

As one of the Co- investigators proposed for the seed money project titled "Structure based design and functional evaluation of potential inhibitors against HPV E6 protein" has left the institution i.e RCASC, I would like to include Dr. Amarnath Satheesh, Assistant Professor, Department of Biochemistry as the Co- Investigator. This is to bring to your kind notice and approval.

Thanking you,

Sincerely,

V. Vani 25/09/'20

Dr. Vemula Vani

Name and signature of Principal Investigator

H. Amarnath

Dr. Amarnath Satheesh

Name and signature of Co- Investigator

Shilpa. H 25/9/20

S. G. Prof 25/9/20

B. Nagaghan 25/9/2020

Principal

Note: Investigators must ensure that prudent business decisions are made of the expenditure of funds, and must monitor Financial Conflicts of Interest, Nepotism, and Research Misconduct. Principal investigator and the co-investigator has to give an undertaking that in case of the exit of any one of the person ,the other person should complete the project and submit the UC in the stipulated time, however failing to do so ,the amount sanctioned is going to be recovered from the person/s.

Principal

RAMAIAH
College of Arts, Science
& Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Vemula Vani
Department	Microbiology
Affiliation	RCASC
Name of the Co-Principal Investigator	Sanjay Prasad[1], Dr. Amarnath Satheesh[2],
Department	[1]Inorganic and physical chemistry, [2]Biochemistry
Affiliation	[1]IISc,[2]RCASC
Title of the Proposal	
Structure based design and functional evaluation of potential inhibitors against HPV E6 protein	

Sl. No	Item	BUDGET			Amount (In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	Equipment 1. Workstation for Bioinformatics software 2. Discovery Studio software (Outsourcing) 3. Hot plate 4. Melting point apparatus 5. Tissue culture facility	1,70,000 20,000	 3000 24,000		1,70,000 20,000 3000 24,000 10,00,000
2.	Consumables 1. Glassware 2. Chemicals		20,000 30,000	20,000 30,000	100,000
3	Travel	10000	10000	10000	30,000
4	Other costs Outsourcing of IR-NMR/GC-MS/XPS/XRD studies/SEM& TEM		40,000		40,000
	Grand total (requested)				**13,87,000/-**
	Grand total (revised)				3,87,000/-

RCASC does not have cell culture facility. So for the feasibility of the project the PI can access either facility at IISc or RMC.

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Approved by Government of Karnataka, Approved by AICTE, New Delhi.
Recognized by UGC under 2F & 12B of UGC act 1956

Ref No: PO/ CIR/ 2020-21/018

Date: 20-10-2020

To,
Dr. Nirmala Devi,
Assistant Professor, Department of Microbiology,
RCASC.

Madam,

Sub: Approval of Seed Funding

I am glad to inform you that the RCASC seed funding proposal submitted by you has been approved after due evaluation. This project will be supported by internal funding from college. The terms and conditions of approval/sanction are as detailed below:

Project Title/Reference Number	PI	Co-PI(s)	Total Approved Cost (in rupees)	Time frame	
				From	To
Control and detoxification of Mycotoxins in food and feed- A biological approach	Dr. Nirmala Devi, Assistant Professor, Department of-Microbiology, RCASC.	Dr. Manjunath AS, Assistant Professor, Department of-Microbiology, RCASC.	**3,10,000** Break-up Equipment 40,000 Consumables 1,90,000 Outsourcing 80,000	November 2020	November 2022

Standing Research Committee will interact with you to monitor progress and provide necessary support and guidance. It is my hope that you will achieve the objectives stated for the proposed research work within the time stipulated.

1. All the request for release of funds under the project should be sent to the Principal through the Head of Research, RCASC as and when required
2. In case, the Principal investigator leaves RCASC he/she shall handover all the resources And findings to the person identified by the Principal
3. In case, the project results in applying patent same shall be made in the joint name of RCASC

As RCASC has made a conscious decision to encourage research of international standard, I am sure you will also make every effort to successfully complete the deliverables of the project as per the tenure agreed.

Please sign the acknowledgement/consent letter submitted to you and forward the same to the Head of Research, RCASC.

I wish you success in your research endeavours.

With my very best wishes

Received
Nirmala Devi
23/10/2020

Yours faithfully,
Principal
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar

RAMAIAH
College of Arts, Science & Commerce

DEPARTMENT OF MICROBIOLOGY

25. 09. 2020

To,
The Principal,
RCASC,
Bengaluru.

From,
Dr. Nirmala Devi. D,
Department of Microbiology,
RCASC,
Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal.

Dear Madam,

I, Dr. Nirmala Devi. D, Assistant Professor, Department of Microbiology and Dr. Manjunatha. A. S, Assistant Professor, Department of Microbiology, have submitted the proposal entitled "Control and detoxification of Mycotoxins in food and feed- A biological approach" for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.

As per the statement in our proposal, this project will be completed in the next 3 years from the start day of the project (01. 11. 2020).

We are happy to abide with the Terms & Conditions as mentioned by the institution.

Yours Sincerely,

Nirmala Devi 25/9/2020
PI: Dr. Nirmala Devi. D

A.S.M 25/09/2020
Co-PI: Dr. Manjunatha. A. S

Copy to HOD
Copy to Head of Research

Note: Investigators must ensure that prudent business decisions are made of the expenditure of funds, and must monitor Financial Conflicts of Interest, Nepotism, and Research Misconduct. Principal investigator and the co-investigator has to give an undertaking that in case of the exit of any one of the person ,the other person should complete the project and submit the UC in the stipulated time, however failing to do so ,the amount sanctioned is going to be recovered from the person/s.

Principal

RAMAIAH
College of Arts, Science
& Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Nirmala Devi
Department	Microbiology
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Manjunath A S
Department	Microbiology
Affiliation	RCASC
Title of the Proposal	
Control and detoxification of Mycotoxins in food and feed- A biological approach	

Sl. No	Item		BUDGET			Amount (In Rupees)
			1st Year	2nd Year	3rd Year	Total
1.	Equipment	Micropipettes	25,000			1,50,000 (40000)
		UV Cabinet	15,000			
		UV Spectrometer	1,10,000			
2.	Consumables	Glassware	60,000	20,000		80,000
		Chemicals	80,000	20,000		1,00,000
		Miscellaneous	15,000 (5000)	10,000 (0)	5,000	30,000 (10,000)
3	Other costs (Outsourcing)	HPLC analysis		30,000 (20,000)		90,000 (80,000)
		GC-MS analysis		30,000		
		PCR sequencing			30,000	
	Grand total					**4,50,000**
	Grand total revised					**3,10,000**

This project also requires UV Spectrophotometer. It also demands a safe lab space for pursuing contaminated food and feed samples, which can be availed at RCASC.

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Approved by Government of Karnataka, Approved by AICTE, New Delhi.
Recognized by UGC under 2f & 12B of UGC act 1956.

Ref No: PO/ CIR/ 2020-21/021

Date: 20-10-2020

To,

Dr. Vinutha Gowda,
Assistant Professor, Department of Biotechnology
RCASC.

Madam,

Sub: Approval of Seed Funding

I am glad to inform you that the RCASC seed funding proposal submitted by you has been approved after due evaluation. This project will be supported by internal funding from college. The terms and conditions of approval/sanction are as detailed below:

Project Title/Reference Number	PI	Co-PI(s)	Total Approved Cost (in rupees)	Time frame	
				From	To
Study and evaluation of Cymbopogon species on Methicillin Resistant Staphylococcus aureus (MSRA)	Dr. Vinutha Gowda, Assistant Professor, Department of Biotechnology RCASC.	Dr. Lakshmikanth RN, Assistant Professor, Department of Biotechnology RCASC.	**1,15,743** Break-up Equipment 53,993 Consumables 61,750	November 2020	November 2022

Standing Research Committee will interact with you to monitor progress and provide necessary support and guidance. It is my hope that you will achieve the objectives stated for the proposed research work within the time stipulated.

1. All the request for release of funds under the project should be sent to the Principal through the Head of Research, RCASC as and when required
2. In case, the Principal investigator leaves RCASC he/she shall handover all the resources And findings to the person identified by the Principal
3. In case, the project results in applying patent same shall be made in the joint name of RCASC

As RCASC has made a conscious decision to encourage research of international standard, I am sure you will also make every effort to successfully complete the deliverables of the project as per the tenure agreed.

Please sign the acknowledgement/consent letter submitted to you and forward the same to the Head of Research, RCASC.

I wish you success in your research endeavours.

With my very best wishes

Recieved
Vinutha M.
23/10/20

Yours faithfully,
Principal
M S Ramaiah College of Arts, Science & Commerce
MSR Nagar

RAMAIAH
College of Arts, Science & Commerce

BIOTECHNOLOGY AND GENETICS

To,
The Principal,
RCASC,
Bengaluru.

From,
Dr. Vinutha M.,
Department of Biotechnology and Genetics,
RCASC,
Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal.

Dear Madam,

I, Dr. Vinutha M., Assistant Professor, belonging to Department of Biotechnology and Genetics and Dr. Lakshmi Kanth. R. N. Assistant Professor, Department of Biotechnology and Genetics have submitted proposal entitled "Study and evaluation of *Cymbopogon* species on Methicillin Resistant *Staphylococcus aureus* (MRSA)" for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.

As per the statement in our proposal, this project will be completed in the next 2 years (or 3 years) from the start day of the project (01/11/2020), provided the necessary equipments, chemicals and students are available for the conduction of the project.

We are happy to abide with the Terms & Conditions as mentioned by the institution.

Sincerely yours,

Vinutha M 25/9/20
Dr. Vinutha M.

Dr. Lakshmi Kanth. R. N.

RAMAIAH
College of Arts, Science
& Commerce

Research and Development Fund
Evaluation Criteria

Name of the Principal Investigator	Dr. Vinutha M
Department	Biotechnology& Genetics
Affiliation	RCASC
Name of the Co-Principal Investigator	Dr. Lakshmikanth RN
Department	Biotechnology& Genetics
Affiliation	RCASC
Title of the Proposal	
Study and evaluation of Cymbopogon species on Methicillin Resistant Staphylococcus aureus (MSRA)	

Requested Budget

Sl. No	Item	BUDGET	Amount (In Rupees)
		1st Year	Total
1.	Equipment	Clavengers Sohxlet Distilled water plant	6875 36,618 10,500
2	Research Assistant		5000
4.	Travel		5000
5.	Other costs	Plant samples ATCC Culture TLC HPLC GCMS Sub total	2000 2500 17,250 15,000 15,000 51,750
	Grand total		**1,15,743/-**

This project also requires **UV Spectrophotometer**

M S Ramaiah College of Arts, Science and Commerce

Dept. Of Biochemistry

Seed money project report-2021

Project Title: Female Infertility Due to anovulation detected by gene sequencing

PI: Dr. Krishna Rao, PhD, Assistant Professor, Dept. Of Biochemistry (PG), MSRCASC

Co PIs: Dr. Sujani BK, Professor & HoD, Dept. Obstetrics and Gynecology, RMC&H.

Dr. KNC Murthy, Principal Scientist, Central Research Laboratory, RMC&H.

Dr. Nagagireesh Bojanala, Dean & Head of Research, Department of Lifesciences, MSRCASC

Report prepared: Dr. Krishna Rao, PhD, Assistant Professor, Dept. Of Biochemistry (PG), MSRCASC

Suggestions: Dr. Sujani, RMC&H and Dr. Priyanka

Work done: DRP number from Ramaiah Medical College

Ethical clearance from Ramaiah Medical College (attached)

Sample collection is going with Dr. Priyanka at Ramaiah Milann hospital. (Attached email).

Sequencing: Talks are going on with Strand life sciences, DART and Molsys

J. K
12/9/21

S. G.

Head of the Department
CHEMISTRY / BIO-CHEMISTRY
M S Ramaiah College of Arts,
Science & Commerce

RAMAIAH
Medical College

ETHICS COMMITTEE

Reg. No. ECR/215/Inst/... Renewed ... IRB 19

MSRMC/EC/AP-02/12-2020

Date: 01 Dec 2020

To,
Dr. Sujani BK,
Department of Obstetrics and Gynaecology,
M. S. Ramaiah Medical College,
Bangalore - 560 054

Sub: "Study of Female Infertility due to anovulation detected by gene sequencing".

****

The above mentioned Academic Protocol was placed before the Ethics Committee in the meeting held on 27th Nov, 2020 and the same was approved by the Ethics Committee. The study has been approved for a period of 2 years. The Ethics Committee expects to be informed about:

- Any Adverse Event and Serious Adverse Event occurring in the course of the study,
- Any amendments to the protocol, change of study procedure, site/investigator and premature termination of the study with reason along with summary and,
- Progress of the study, final at the end of the study along with interim reports to be given at six months from the date of approval of the study.

Kindly note that a copy of the consent document to be given to the study participant giving the consent and the members of Ethics Committee have rights to monitor the trial with prior intimation.

Anuradha

(Dr. Anuradha HV)

Member Secretary - ECSRY
For ETHICS COMMITTEE
M S Ramaiah Medical College and Hospitals
Bangalore-560054

M S Ramaiah Nagar
MSRIT Post
Bangalore 560 054
www.ramaiah-india.org

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E msrmedical@msrmc.ac.in
msrmedical@gmail.com
medicalcollege@ramaiah-india.org

M S Ramaiah Medical College & Hospitals

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Recognized by UGC under 2F & 12B of UGC act 1956

Letter of Association

24-09-2020.

Project title: Premature Ovarian Failure (POF) mutation detection by Exome Capture and Next Generation Sequencing.

Background and Rationale: In humans, premature ovarian failure (POF) is defined as a primary ovarian defect characterized by absence of menarche (primary amenorrhea), or premature depletion of ovarian follicles /arrested folliculogenesis before the age of 40 years (secondary amenorrhea). POF is a global problem that afflicts 1-4% of women under age 40, and genetics contributes significantly to POF. Importantly, POF in vast majority of women is non-syndromic, i.e., only affects ovarian function. The search for genes critical for human ovarian failure is hampered by lack of patients with fortuitous autosomal translocations, small families, and by relatively uninformative clinical phenotyping. To date, classical genetics, linkage, and association studies have not been useful tools to uncover the plethora of genes involved in ovarian failure. In the present study, we propose to apply high throughput sequencing for mutation detection and to comprehensively examine hundreds of candidate ovarian failure genes. Our long-term approach is to apply whole exome sequencing to identify mutational hotspots for POF within human populations. Towards this goal, we aim to sequence exomes of 5 affected females from 3 families to identify causative mutations.

Investigators: The project involves mutual collaboration of expertise between Ramaiah Medical College & Hospital (RMCH) and Ramaiah College of Arts, Science, and Commerce (RCASC). From RMCH, Dr. Sujani, Professor & HoD, Dept. Obstetrics and Gynaecology will be the Principal Investigator (PI) and Dr. KNC Murthy, Principal Scientist, Central Research Laboratory will be the Co-Principal Investigator (Co-PI). From RCASC, Dr. Krisha Rao J, Assistant Professor, Department of Biochemistry and Dr. Nagagireesh Bojanala, Dean of Research, Department of Life sciences will be Co-PIs. Further, MolSys Scientific, a genomic analytics provider from Bengaluru will assist in the NGS data analysis.

Project Summary: The present project involves collection of DNA samples from affected females, isolation of genomes, exome capture and NGS analysis. Firstly, selecting groups of women and participating family members that met the following criteria: menopause prior to age 30 at least two times tested for follicle stimulating hormone (FSH) levels greater than 40 IU/L, normal karyotype, and negative screening for FMR1 mutation will be done. Secondly, blood samples will be collected from all of the participating women and their family members with consent as per the pedigree below:

POF-1 POF-2 POF-3

M S Ramaiah Nagar
MSRIT Post
Bangalore 560 054
+91 80 2360 0966 8597
+91 80 2360 6905
+91 80 2360 6213
principal.msrcasc@gmail.com
www.msrcasc.edu.in

Finally, we aim to capture the whole exomes of the affected family members with POF (shaded circles in the pedigree) through Next Generation Sequencing to identify mutations. We believe that the possibility of finding the causative mutation in these three families is high for the following reasons: 1) pedigrees conform to autosomal recessive inheritance, 2) POF developed at less than 30, 3) Parental DNA available to determine if putative nucleotide variants are inherited or arose *de novo*.

Roles & Responsibilities: Dr. Sujani will be assisting in identifying effected families with POF, providing blood samples, and collecting consent forms through proper channel. Dr. Krishna Rao J will help in collecting genomes from DNA Samples, pedigree and exome analysis, and manuscript preparation. Dr. KNC Murthy will assist in data analysis and manuscript support. Dr. Nagagireesh Bojanala will help in data analysis, manuscript preparation, and NGS support in association with MolSys Scientific.

Outcomes: There are close to 550 autosomal genes implicated in ovarian development, and only a handful of these genes have been assayed for mutations in women with POF. Currently, karyotyping and FMR1 premutation carrier testing are the only indicated factors in identifying women with idiopathic POF. Importantly, it is shown that that candidate gene approaches are inefficient and at times uninformative for POF and it would be beneficial to explore Whole Genome Sequencing. Thus; the current proposal represents our first foray to use exome capture and Next generation sequencing to identify mutations in women with POF. The results from NGS analysis will identify novel genes that are part of ovisome playing a key role in ovarian development. Importantly, the preliminary results obtained from this pilot study can allow us to apply for external research and infrastructure grants (NGS, FACS Machine, proteomics facility etc.,) and also results in high-impact publications.

(Dr. Nagarathna A) 25/9/2020
Principal, RCASC

Dr. A. NAGARATHNA
Professor & Principal
M.S. Ramaiah College of Arts
Science & Commerce
MSRIT Post, Bangalore - 560 054

(Dr. Nagagireesh Bojanala) 25/09/2020
Head of Research, RCASC

Dean of Sciences
Ramaiah College of Arts, Science & Commerce
MSRIT POST, MSR NAGAR
BENGALURU-560 054.

26/9/20
PI: Dr. Sujani
Professor & HoD,
Dept. Obstetrics and Gynecology
RMC&H.

Professor & HOD
Dept. of Obstetrics & Gynecology
M.S. Ramaiah Medical Teaching Hospital
Bangalore - 560 054.

25/9/2020
Co-PI: Dr. Krishna Rao J
Asst. Professor,
Department of Biochemistry,
RCASC.

25/09/2020
Co-PI: Dr. KNC Murthy,
Principal Scientist,
Central Research Laboratory,
RMC&H.

25/09/2020
Co-PI: Dr. Nagagireesh Bojanla
Dean & Head of Research
Department of Lifesciences,
RCASC.

M S Ramaiah Medical College, Bangalore

Revised Research Protocol Submission

Ethics Committee meeting held: 17-11-2020, 2:00 PM IST

EC Comments: Please see Below (Comment 1 – Comment 11)

Project Title: Female Infertility Due to anovulation detected by gene sequencing

PI: **Dr. Sujani BK,** Professor & HoD, Dept. Obstetrics and Gynecology, RMC&H.

Co PIs: **Dr. Krishna Rao, PhD,** Assistant Professor, Dept. Of Biochemistry (PG), MSRCASC

Dr. KNC Murthy, Principal Scientist, Central Research Laboratory, RMC&H.

Dr. Nagagireesh Bojanala, Dean & Head of Research, Department of Lifesciences, MSRCASC.

We greatly welcome the comments of Ethics committee (EC) and answered/revised according to EC suggestions. We have revised the research protocol and included all necessary details suggested by Ethics Committee (EC) (Attached).

Comment 1: The title of the study is not understandable and there is a mismatch between the title of the study and objectives, hence the same has to be modified.

Response: We appreciate EC suggestion, accordingly we changed the title with match of objectives in simple format.

Title: Female Infertility Due to anovulation detected by gene sequencing

Comment 2: Define Premature Ovarian Failure (POF).

Response: We have changed project title suggested by EC. In humans, Ovulation failure (OF) is defined as a primary ovarian defect characterized by absence of menarche (primary amenorrhea), or premature depletion of ovarian follicles /arrested folliculogenesis before the age of 40 years (secondary amenorrhea). Ovarian reserve is reduced in infertile women which is indirectly detected by Anti-mullarian Hormone (AMH) levels less than 1.0 ng/ml

Comment 3: The copy MoU with private Lab to be submitted and to be mentioned in the protocol.

Response: Attached the MOU Copy (Attached). MOU details are mentioned in revised research protocol.

Comment 4: Informed consent form to be submitted.

Response: Please find attached sample copy of Consent form (Attached). Currently, we are enrolling patients and we will submit filled consent forms once we enrol all 15 patients with criteria mentioned in the revised protocol.

Comment 5: Content of the study protocol to be written in detail with respect to Objective, methodology and procedure.

Response: We welcome suggestion of EC and we have rewritten content of study in detail with respect to objective, methodology and procedure. Please see attached revised research protocol (Attached Research protocol).

Comment 6: The inclusion of the patient has to be modified as per the discussion.

Response: As per EC suggestion we have modified inclusion criteria of the patient. We have included 15 ovulation failure patients in the current study. Patients tested for AMH levels less than 1.0 ng/ml, normal karyotype, and negative screening for FMR 1 mutation.

Comment 7: Outcomes of the study has to be modified.

Response: We value and respect EC suggestions and modified outcomes of our study accordingly

1. Identification of Genetic mutations for infertility in women (Immediate AIM)
2. Possible Preparation of Diagnostic Kit or Chip for baby girls (Long term AIM)

Comment 8: Whenever there is a hypothesis to test, appropriate sample size need to be justified

Response: Sample size is justified in revised research protocol (Attached Research protocol). We have included 15 Ovulation failure patients in the proposed study. As we are capturing exons of human DNA from each OF patient, each OF Patient will be considered to be significant if mutations were found in exons that affect the structure and function of specific protein. We are examining human genes sequences and comparing with reference Human genome sequences.

Comment 9: Statistical methods of analysis not indicated

Response: We have added statistical methods of analysis in revised research protocol (Attached Research protocol)

Comment 10: Methodology is vague and requires more detailed description.

Response: We have rewritten methodology with all necessary details in revised research protocol (Attached Research protocol)

Comment 11: Study design to be mentioned in the protocol

Response: We added study design in revised research protocol.

M S Ramaiah Medical College, Bangalore

Template for the Research Project Protocol Submission

Title of the research project: **Female Infertility Due to anovulation detected by gene sequencing**

1. Unique Research ID issued by DRP with date: **DRP/EFP/0387/19**
2. Investigators:

Principal Investigator, Phone No & Email:

1. **Dr. Sujani BK**
   Professor & HoD,
   Dept. Obstetrics and Gynecology,
   RMC&H.

20/11/20 Professor & HOD
Dept. of Obstetrics & Gynecology
M.S. Ramaiah Medical Teaching
Bangalore - 560 054.

Co-Investigator(s):

2. **Co-PI: Dr. Krishna Rao J**
   Assistant Professor,
   Department of Chemistry/Biochemistry,
   RCASC.

20/11/20

3. **Co-PI: Dr. KNC Murthy,**
   Principal Scientist,
   Central Research Laboratory
   RMC&H.

20/11/20

4. **Co-PI: Dr. Nagagireesh Bojanala**
   Dean & Head of Research
   Department of Lifesciences,
   RCASC.

20/11/2020

3. Departments involved:
   1. Obstetrics and Gynecology, RMC&H,
   2. Central Research Laboratory, RMC&H.
   3. Department of Chemistry/Biochemistry, RCASC.
   4. Department of Lifesciences, RCASC

4. **Summary of the proposed study (250 words)**

In humans, Ovulation failure (OF) is defined as a primary ovarian defect characterized by absence of menarche (primary amenorrhea), or premature depletion of ovarian follicles /arrested folliculogenesis before the age of 40 years (secondary amenorrhea). Ovarian reserve is reduced in infertile women which is indirectly detected by Anti-mullarian Hormone (AMH) levels. Our aim is to identify genetic mutations that lead to infertility in women. The proposed project involves collection of blood samples from affected infertility females, isolation of DNA, exome capture and NGS analysis. Firstly, selecting groups of women and participating family members (next step after results obtained from proposed study) that met the following criteria: ovarian failure (OF) prior to age 30 at least two times tested for Anti-mullarian Hormone (AMH) levels levels less than 1.0 ng/ml, normal karyotype, and negative screening for FMR1 mutation will be done. Secondly, blood samples will be collected from all of the participating women with consent; Finally, we aim to capture the whole exomes of the affected women with OF through Sequencing to identify mutations. We believe that the possibility of finding the causative mutation in these women is high for the following reasons: 1) To conform to autosomal recessive inheritance, 2) OF developed due to AMH levels 3) Parental DNA available to determine if putative nucleotide variants are inherited or arose *de novo*.

5. **Any work already done:** We have collected database of genes to be investigated, Done MOU with Molsys informatics for exome capture from DNA (Annexure 3)

6. **Justification or Need for the study:**

In humans, ovarian failure (OF) is defined as a primary ovarian defect characterized by absence of menarche (primary amenorrhea), or premature depletion of ovarian follicles arrested folliculogenesis before the age of 40 years (secondary amenorrhea). OF is a global problem that afflicts 1-4% of women under age 40, and genetics contributes significantly to OF. Importantly, OF in vast majority of women is non-syndromic, i.e., only affects ovarian function. The search

for genes critical for human ovarian function is hampered by lack of patients with fortuitous autosomal translocations, small families, and by relatively uninformative clinical phenotyping. To date, classical genetics, linkage, and association studies have not been useful tools to uncover the plethora of genes involved in ovarian failure. In the proposed study, we propose to apply high throughput sequencing for mutation detection and to comprehensively examine hundreds of candidate ovarian failure genes. Our long-term approach is to apply whole exome sequencing to identify mutational hotspots for OF within human populations. Towards this goal, we aim to sequence exomes of 15 affected women to identify causative mutations.

7. **Aims & Objectives:**

1. To identify genetic mutations in OF patients by using sequencing methods.

8. **Hypotheses (if applicable):** Genes preferentially expressed in oocytes play important role in human premature ovarian failure.

9. **Review of literature: (within 500 words)**

A. Mouse models of non-syndromic ovarian

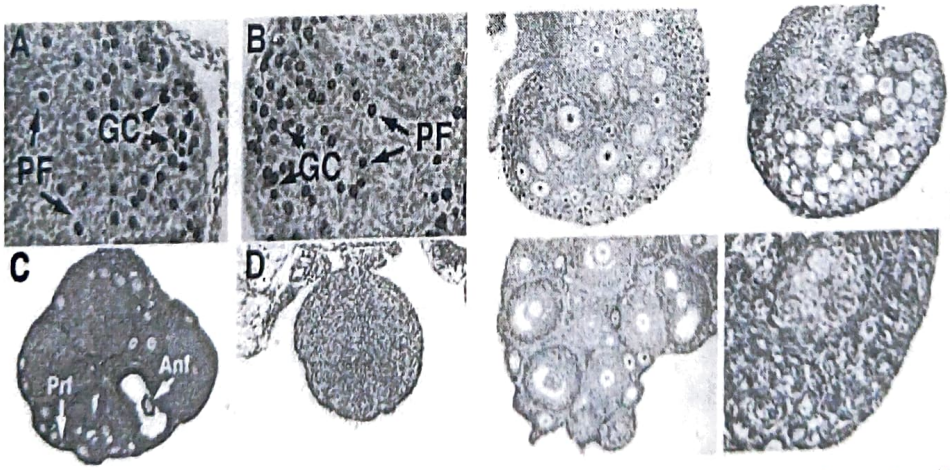


Figure 1. Germ cell specific transcriptional regulators activate rapid loss of oocytes. (**A, C**) wild type and (**B, D**) *Nobox*$^{-/-}$ ovaries. Newborn ovaries (**A, B**) were incubated with anti-GCNA1 antibodies to show germ cells in brownish red color and similar histology. Both primordial follicle (PF) and germ cell cysts (GC) are present in wild type and *Nobox*$^{-/-}$ newborn ovaries. *Nobox*$^{-/-}$ ovaries are devoid of germ cells in sexually mature females (**D**, 6 wks). Specific excision of *Lhx8* by *Gdf9Cre* in primordial oocytes results in their rapid activation (**G**) and eventual loss (**H**) in these conditional knockouts. W-Wild type, K-Knockout (Jagalamudi K et al, 2010 and Unpublished data)

our research work in the area of women infertility and several Others reported oocyte-specific genes that play critical functions in oogenesis. These genes include transcriptional regulators such as *Nobox, Figla, Sohlh1*, and *Lhx8*[13-15]. Mice deficient in these genes suffer from non-syndromic ovarian failure. Transcriptional regulators that are also expressed in the somatic component of the ovary such as *Foxl2*[16] and *Foxo3a*[17], also mimick premature ovarian failure. Homozygous deficiency of Nobox, *Figla, Sohlh1 and Lhx8* causes infertility and accelerates loss of oocytes so that few oocytes survive by the time that mice reach sexual maturity. For example, *Nobox* deficiency results in normal appearing new born mouse ovaries (Figure 1A, B) with approximately equal number of germ cells that disappear in *Nobox* knockouts by the time mice reach sexual maturity (Figure 1 C,D). Moreover, conditional knockout of *Lhx8* locus indicates that oocyte specific pathways suppress primordial to primary follicle transition, and that postnatal inactivation of *Lhx8* leads to primordial oocyte activation (Fig. 1E-H). Using mouse models research data, we have not only identified potential candidate genes for premature ovarian failure, but also uncovered ovarian specific genetic pathways using expression microarray database. We have used my research data, as well as published data of others, Jackson database of mouse mutants, and ovarian kaleidoscope gene collection, to determine that 550 genes have been implicated in ovarian development. This set of genes we define as **"ovariome".** We hypothesize that most of the ovarian pathology will reside within these genes.

B. Functional mutations in *NOBOX* and *FIGLA* account for some cases of premature ovarian failure.

Dr. Rajkovic lab at Baylor college of Medicine have used candidate gene approach, based on our mouse studies to identify genes that play a role in POF. They have sequenced the coding exons of the *NOBOX* gene in 96 Caucasian women with POF[11], and identified two missense mutations in the homeodomain of two affected women with POF, one of which affects homeodomain function. They also examined women with POF for mutations in *FIGLA*, a basic helix-loop-helix transcription factor preferentially expressed in oocytes. Among 100 women, and identified a 22 nucleotide deletion that truncated the protein and rendered individual haploinsufficient[12]. Haploinsufficiency in human transcriptional regulators is a widely accepted cause of many genetic sydromes. The case association genetic studies

suggest that mutations in *NOBOX* and *FIGLA* account for only a small percentage of women with POF. **This is not surprising given the current knowledge from animal models that at least 550 genes are involved in ovarian development and failure.**

Materials and Methods (or) Research Design and Methods:

Human subjects: Blood samples will be collected from all of the participating women with informed consent (Attached with protocol). All affected women will have idiopathic OF, with less AMH levels 1.0 ng/ml recorded on two or more occasions, cessation of menses before age 30, normal karyotype, and negative screen for the FMR1 permutation.

Study Design: Clinical study

Ovarian failure (OF) patient's enrolment with selected criteria (Normal karyotype, No FMR1 mutation etc)

↓

Collection of Blood samples

↓

Extraction of DNA by using Quiagen DNA isolation

↓

Quality Check of DNA by using gel electrophoresis (3-4 ng/ul of DNA, quality- A260/280>1.8

↓

Sequencing of patient DNA by using ABI SOLiD sequencing

↓

Patient DNA seq Data Analysis with reference to Human genome on UNIX platform

Study Period:

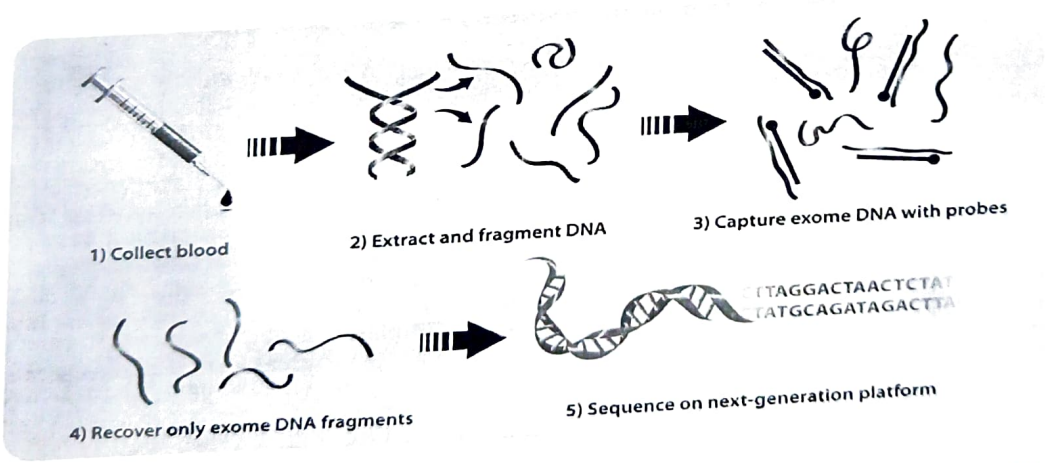
a) 1 year for OF Patients Enrolment, Blood sample collection, DNA isolation, Exome capture

b) 6-9 months' period for data analysis. In total approximately 2 years' time

Inclusion and exclusion criteria: All affected women will have idiopathic OF, with less AMH levels (less than 1.0 ng/ml) recorded on two or more occasions, cessation of menses before age 30, normal karyotype, and negative screen for the FMR1 permutation will be included in proposed study

Sample size: 15 Ovarian failure patients. as we are capturing exons of human DNA from each OF patient, each OF Patient will be considered to be significant if mutations were found in exons that affect the structure and function of specific protein. We are examining approx. 20,000 human genes sequences and comparing with normal Human genome sequences. Each patient will be considered as significant and it will give exact genetic analysis of patient compared with normal reference Human genome. With Current scenario, 15 patients' genetic analysis is very big due to its high technology and cost and importantly completely personal diagnosis.

Detailed description of Experimental plan:



We will extract the genomic DNA from blood samples of the participants in this study. We will use target DNA enrichment with whole exome capture (SureSelect from Agilent), and ABI SOLiD sequencing system at MOLSYS informatics at Bengaluru (we have MOU with MOLSYS). The new ABI SOLiD 4 sequencing platform will allow us to achieve 50x coverage.

Such coverage will ensure that analyses of the sequencing data will have high probability of discovering pathogenic nucleotide variants. Although we thought initially whether to use the whole exome vs. targeted, 550 ovarian enriched exome set, we decided to go with the whole exome capture. We made this decision because the vast majority of our 550 genes are in the new whole exome set (the new set covers 50Mb of exomes), and it will be more time consuming to generate the custom exome array versus using what is already available. MOLSYS scientific located at REVA university incubation center will perform the capture and DNA sequencing. MOLSYS scientific has acquired the Linux Server and we will utilize the bioinformatic expertise of their experts along with us (we have experience of analysing RNA Seq data, Published in 2015) to analyse the massive sequencing data.

DNA Sequencing and Recovery of Pathogenic Sequence Variants:

SOLiD generated sequencing data will be processed, aligned and mapped to the reference human genome UCSC hg19). Dr. Krishna Rao and Dr. Gireesh at Ramaiah college along with Bioinformaticians at MOLSYS will statistically evaluate and identify sequence variant calls relative to reference, including single nucleotide polymorphisms (SNPs) and small deletions/insertions between 1-10 bps (DIPs). Such variants and DIPS will be filtered through public sequence repositories such as dbSNP (http://ncbi.nlm.nih.gov/dbsnp), SeattleSNPs (http://pga.gs.washington.edu), SNPedia (http://www.snpedia.com), the International HapMap project (http://www.hapmap.org), the 1000 genomes project (http://www.1000genoms.org). Non-synonymous SNPs (missense mutations that would change an amino-acid codon or nonsense mutations that would cause premature truncation of a reading frame), or DIPs that would be predicted to alter the protein reading frame (coding DIPs) will be of greatest interest, as most of the known human mutations are predicted to be loss of function mutations (nonsense, frame-shift, splicing defects). Because we are assuming autosomal recessive inheritance, we will be able to filter the vast majority of SNPs through public databases, and we will require that candidate mutations need to be present in both alleles of the affected OF participants. Since we will also collect parental DNA, we can quickly genotype parents for the presence or absence of such candidate mutations. Other forms of inheritance are possible, including biallelic and triallelic, and we will also include these possibilities in our modeling, as well as autosomal dominant inheritance with reduced penetrance. These studies will help us show that we can

perform whole exome capture, high throughput sequencing and analysis of massive DNA data. Future studies will involve functional studies to determine the significance of candidate mutations, either *in vitro* or *in vivo* by generating appropriate animal models.

Potential Risks and Benefits:

1. There is no risk involved as we are collecting small amount of Blood.
2. The big benefit is that the patient will know the putative mutations

Place of Study:

1. CRL laboratories, RMC&H, Bengaluru
2. Molsys scientific, Reva University
3. MSRCASC, Bengaluru

Biological materials required: Blood

Statistical Methods: Sequencing data from patient's DNA will be compared with reference human genome and find any mutations are present in patients. Analyzing data with reference genome is completely automated. We will statistically evaluate and identify sequence variant calls relative to reference, including single nucleotide polymorphisms (SNPs) and small deletions/insertions between 1-10 bps (DIPs). Such variants and DIPS will be filtered through public sequence repositories such as dbSNP (http://ncbi.nlm.nih.gov/dbsnp), SeattleSNPs (http://pga.gs.washington.edu), SNPedia (http://www.snpedia.com), the International HapMap project (http://www.hapmap.org), the 1000 genomes project (http://www.1000genoms.org). Non-synonymous SNPs (missense mutations that would change an amino-acid codon or nonsense mutations that would cause premature truncation of a reading frame), or DIPs that would be predicted to alter the protein reading frame (coding DIPs) will be of greatest interest, as most of the known human mutations are predicted to be loss of function mutations (nonsense, frame-shift, splicing defects). As this is personal diagnosis single patient is enough to inform if the person is having any genetic defect.

Ethical considerations and methods to address issues: **It is very simple routine procedure followed by RMC&H OR any other diagnostic center to collect blood samples with consent from patients**

Implications of the study: There are close to 550 autosomal genes implicated in ovarian development, and only a handful of these genes have been assayed for mutations in women with POF. Currently, karyotyping and FMR1 premutation carrier testing are the only indicated factors in identifying women with idiopathic POF. Importantly, it is shown that that candidate gene approaches are inefficient and at times uninformative for POF and it would be beneficial to explore Whole Genome Sequencing. Thus, the current proposal represents our first foray to use exome capture and Next generation sequencing to identify mutations in women with POF. The results from NGS analysis will identify novel genes that are part of ovisome playing a key role in ovarian development. Importantly, the preliminary results obtained from this pilot study can allow us to apply for external research and infrastructure grants (NGS, FACS Machine, proteomics facility etc.,) and also results in high-impact publications.

14. Budget and proposed funding source: **Please see Attached Budget and funding source documents**

15. References

1. Simpson, J.L. & Rajkovic, A. Ovarian differentiation and gonadal failure. *Am J Med Genet* **89**, 186-200 (1999).
2. Skillern, A. & Rajkovic, A. Recent developments in identifying genetic determinants of premature ovarian failure. *Sex Dev* **2**, 228-243 (2008).
3. Coulam, C.B., Adamson, S.C. & Annegers, J.F. Incidence of premature ovarian failure. *Obstet Gynecol* **67**, 604-606 (1986).
4. Uygur, D., *et al.* Bone loss in young women with premature ovarian failure. *Arch Gynecol Obstet* **273**, 17-19 (2005).
5. Kalantaridou, S.N., *et al.* Premature ovarian failure, endothelial dysfunction and estrogen-progestogen replacement. *Trends Endocrinol Metab* **17**, 101-109 (2006).
6. Jacobsen, B.K., Heuch, I. & Kvale, G. Age at natural menopause and all-cause mortality: a 37-year follow-up of 19,731 Norwegian women. *Am J Epidemiol* **157**, 923-929 (2003).
7. Woad, K.J., Watkins, W.J., Prendergast, D. & Shelling, A.N. The genetic basis of premature ovarian failure. *Aust N Z J Obstet Gynaecol* **46**, 242-244 (2006).
8. Vegetti, W., *et al.* Inheritance in idiopathic premature ovarian failure: analysis of 71 cases. *Hum Reprod* **13**, 1796-1800 (1998).
9. Snieder, H., MacGregor, A.J. & Spector, T.D. Genes control the cessation of a woman's reproductive life: a twin study of hysterectomy and age at menopause. *J Clin Endocrinol Metab* **83**, 1875-1880 (1998).
10. van Asselt, K.M., *et al.* Heritability of menopausal age in mothers and daughters. *Fertil Steril* **82**, 1348-1351 (2004).
11. Qin, Y., *et al.* NOBOX homeobox mutation causes premature ovarian failure. *Am J Hum Genet* **81**, 576-581 (2007).

12. Zhao, H., *et al.* Transcription factor FIGLA is mutated in patients with premature ovarian failure. *Am J Hum Genet* **82**, 1342-1348 (2008).
13. Liang, L., Soyal, S.M. & Dean, J. FIGalpha, a germ cell specific transcription factor involved in the coordinate expression of the zona pellucida genes. *Development* **124**, 4939-4947 (1997).
14. Suzumori, N., Yan, C., Matzuk, M. & Rajkovic, A. Nobox is a homeobox-containing gene preferentially expressed in primordial and growing oocytes. *Mech Dev* **111**, 137-141. (2001).
15. Pangas, S.A., *et al.* Oogenesis requires germ cell-specific transcriptional regulators Sohlh1 and Lhx8. *Proc Natl Acad Sci U S A* **103**, 8090-8095 (2006).

16. Enclosures (eg. Case record form, informed consent, Questionnaire), if any:

a) Revised protocol form specific questions
b) Consent form template
c) Molsys scientific MOU copy
d) Budget approval copy

Gmail Dr. Krishna Rao Jagarlamudi <ankammachowdary1@gmail.com>

Research Protocol -Infertility - Dr. Krishna

4 messages

Dr. Krishna R Jagarlamudi <ankammachowdary1@gmail.com> Thu, Sep 2, 2021 at 11:41 AM
To: priyanka.dilip@milann.com

Dear Dr. Priyanka Madam,

Please find the attached research protocol. Please let me know if any clarifications are needed.

Looking forward to hearing from you

Dr. Krishna Rao Jagarlamudi, PhD
Assistant Professor, Dept. Of Biochemistry
RCASC, Bengaluru, KA-54

Dr. Sujani BK Revised Research protocol 2020 (1).pdf
4736K

Mail Delivery Subsystem <mailer-daemon@googlemail.com> Thu, Sep 2, 2021 at 11:41 AM
To: ankammachowdary1@gmail.com

Address not found

Your message wasn't delivered to **priyanka.dilip@milann.com** because the address couldn't be found, or is unable to receive mail.

The response from the remote server was:

```
550 5.1.1 <priyanka.dilip@milann.com>: Recipient address rejected: User unknown in relay
recipient table
```

Final-Recipient: rfc822; priyanka.dilip@milann.com
Action: failed
Status: 5.1.1
Remote-MTA: dns; mx1.ewebdevelopment.com. (159.203.54.48, the server for the domain milann.com.)
Diagnostic-Code: smtp; 550 5.1.1 <priyanka.dilip@milann.com>: Recipient address rejected: User unknown in relay recipient table
Last-Attempt-Date: Wed, 01 Sep 2021 23:11:47 -0700 (PDT)

---------- Forwarded message ----------
From: "Dr. Krishna R Jagarlamudi" <ankammachowdary1@gmail.com>
To: priyanka.dilip@milann.com

RAMAIAH
College of Arts, Science
& Commerce

Seed Money Research Project – Work Plan

Date: 11th Nov., 2020

1) **Principal Investigator (PI):** Dr. Vasantha Kumar Bhaskara
Designation: Assistant Professor/Department of Chemistry/Biochemistry - RCASC

2) **Co-Principal Investigator (Co-PI):** Dr. Vijaya V Mysorekar
Designation: Professor/Department of Pathology-RMCH

3) **Funding approval Date:** 20-10-2020

4) **Title of the Project:** "Molecular Characterization of Cancer Stem Cell Mediated Drug Resistance in Triple Negative Breast Cancer"

5) **Proposed Work Plan:**

5.1 Duration: 6 months (Dec., to May, 2020)

5.2 Specific aims to be addressed:

1. Collecting quotations for the requirement and ordering for the same.
2. Four M.Sc students allotted for the project will be trained to collect literature and get exposed to methodology of the project.
3. Students undergo training at pathology department to make tissue sections and preparation of microscopic slides.
4. Standardization of CD133 IHC for TNBC biopsies.

5.3 Experimental Plan: Immunohistochemistry (IHC) of FFPE tissue samples

5.4 Student Participation (if any): M.Sc Biochemistry Students (No. 4 tentative): 2019-21 Batch

5.5 Consumables and Infrastructure:

Primary Antibodies:

1. Polyclonal CD133 or PROM1 (Cat#PAB12663) from Abnova
2. Phospho-AMPKa Rabbit mAb (Cat#2535S) from CST
3. LC3B Rabbit mAb (Cat#43566S) from CST

5.6 Progress status (if any):

Bhaskara VK, Mittal B, Mysorekar VV, Amaresh N and Simal-Gandara J. Resveratrol, Cancer and Cancer stem cells: A review on past to future. Cur Res Food Sci. 2020 (In Press) https://doi.org/10.1016/j.crfs.2020.10.004

(Dr. Vasantha K Bhaskara)

RAMAIAH
College of Arts, Science
& Commerce

Seed Money Research Project – Work Plan

Date: 12-11-2020

1) Principal Investigator (PI): Dr. Krishna Rao Jagarlamudi, Assistant Professor, RCASC

2) Co-Principal Investigators (Co-PIs):

a) Dr. Saujani BK, Professor & HOD, Dept. Of Obstetrics and Gynecology, RMCH

b) Dr. Nagagireesh B, Dean of Sciences & Research head, RCASC

c) Dr. Murthy KNC, Principal scientist, RMCH

3) Funding approval Date: 24-09-2020

4) Title of the Project: Female Infertility Due to anovulation detected by gene sequencing

5) Proposed Work Plan:

5.1 Duration: 01-12-2020 to 01-05-2021

5.2 Specific aims to be addressed:

a) Enrolment of Ovarian failure patients with informed consent

b) Blood sample collection at RMCH

c) Extraction of DNA from blood samples by using Quiagen DNA isolation Kit

5.3 Experimental Plan:

Ovarian failure (OF) patient's enrolment with selected criteria (Normal karyotype, No FMR1 mutation etc)

↓

Collection of Blood samples

↓

Extraction of DNA by using Quiagen DNA isolation

↓

Quality Check of DNA by using gel electrophoresis (3-4 ng/ul of DNA, quality- A260/280>1.8

5.4 Student Participation (if any): MSc Biochemistry students (3)

MSc Biotechnology students (3)

5.5 Consumables and Infrastructure:

a) Quiagen DNA isolation Kit (1 no)

b) PCR Kit with DNA ladder (1 no)

c) GAPDH Primers (Forward and Reverse)

d) Sterilized tips (1 ml, 100 ul, 10ul and 1 ul)

5.6 Progress status (if any):

c) Two reviews are in process of submission to International Journals

J. K
28/11/30

RAMAIAH
College of Arts, Science
& Commerce

Seed Money Research Project – Work Plan

Date: 12.11.2020

1) **Principal Investigator (PI): Dr. Vemula Vani**

Designation: Assistant Professor, Department of Microbiology, RCASC

2) **Co-Principal Investigator (Co-PI):** 1. Sanjay Prasad

Designation: Senior scientific officer, Indian Institute of Science (IISc), Bangalore

2. Dr. Amarnath Satheesh, Assistant Professor, Department of Biochemistry, RCASC

3) **Funding approval Date:** 20.10.2020

4) **Title of the Project:** Structure based design and functional evaluation of potential inhibitors against HPV E6 protein.

5) **Proposed Work Plan:**

5.1 Duration: 1 year (01.11.2020 to 01. 11. 2021)

5.2 Specific aims to be addressed:

To design potential small molecule inhibitors against HPV E6 protein using structure based approaches.

5.3 Experimental Plan:

For the designing of small molecules, the software discovery studio which is installed in workstation will be used or the software may be outsourced, possibly by an MOU with Maharani Lakshmi Ammanni college for women, Bangalore. The pharmacophore of the small molecule inhibitors will be designed based on the structural information of E6- E6AP interactiotn. This pharmacophore information will be used in database screening to identify the potential inhibitors against HPV E6 protein. Alternatively, the structural information of the binding motif of E6AP will be used in the *de novo* design of small molecule inhibitors. The

binding affinity of these potential small molecule inhibitors will be checked using docking methods. This procedure will result in the identification of potential inhibitors against HPV E6.

5.4 Student Participation (if any):

The following III semester, M.Sc Microbiology students will be involved in the first 6 months of project.

1. Suman B. M (Reg.No: MR190030)
2. Priyanka Seal (Reg.No: MR190017)
3. Mamatha S.E (Reg.No: MR190011)
4. Swathi R (Reg.No: MR190031)

5.5 Consumables and Infrastructure:

Specifications of Workstation for Bioinformatics software

Processor: i7-10700 10Gen 8 Core 16 Thread

Ram: 16 Gb X 2

Graphics: NVIDIA Quadro P5000 or 4 GB

Graphics card must support OpenGL 2.1 or greater supported

Monitor: 27 inch X 2

Hard disk: 1 TB SSD and 1 TB HDD and 512 GB external SSD

Gigabyte Ethernet

Wireless mouse and keyboard

Bluetooth and wifi

Computer UPS backup for one hour.

Webcam, Mic and Speaker

Windows 10 and Ubuntu 20.04 LTS

USB 3 pendrive 32 Gb - 2

5.6 Progress status (if any): Review of literature is done and the preliminary analysis of natural compounds using free software is carried out.

12/11/2020.

Head of the Department
MICRO BIOLOGY
M.S. Ramaiah College of Arts
Science & Commerce
Bangalore - 560 054

12/11/20.

(Dr. Vemula Vani)

RAMAIAH
College of Arts, Science & Commerce

Seed Money Research Project – Work Plan

Date 12. 11. 2020

1) Principal Investigator (PI): Dr. Nirmala Devi. D

Designation: Assistant Professor, Department of Microbiology

2) Co-Principal Investigator (Co-PI): Dr. Manjunatha. A. S

Designation: Assistant Professor, Department of Microbiology

3) Funding approval Date: 20. 10. 2020

4) Title of the Project: Control and detoxification of Mycotoxins in food and feed - A Biological approach.

5) Proposed Work Plan:

5.1 Duration: 6 months (01. 11. 2020 to 30. 04. 2021)

5.2 Specific aims to be addressed:

I. Collection of food, feed samples and plant samples, screening, isolation and Identification of toxigenic fungi.

II. Isolation and Screening of efficient Lactic Acid Bacteria and Plant extracts to control toxigenic fungi.

5.3 Experimental Plan:

III. Collection of food, feed samples and plant samples, screening, isolation and Identification of toxigenic fungi- Mycotoxigenic fungi will be isolated by standard microbiological procedures and subjected to morphological identification based on microscopy.

IV. Isolation and Screening of efficient Lactic Acid Bacteria and Plant extracts to control toxigenic fungi and degradation of AFB_1- Plant extracts will be prepared and LAB isolated from the samples collected. They will be tested for their growth control activity against mycotoxigenic fungi.

5.4 Student Participation (if any):

M. Sc Microbiology III Semester

1. Bikalp Kumar Jha – Reg No MR190008
2. Ann Mary Sebastian– Reg No MR190005
3. Aswathi Nair– Reg No MR190015
4. Maanasha. A– Reg No MR190010
5. Akshay Dyamagond– Reg No MR190003
6. Shrinivas Ramappa Badakal– Reg No MR190025

5.5 Consumables and Infrastructure:

Sl No	Item (Specification)	Quantity
	EQUIPMENT	
1	Micropipette (Variable volume 2-20µl)	1
2	Micropipette (Variable volume 20-200µl)	1
3	Micropipette (Variable volume 100-1000µl)	1
4	UV Cabinet (to view TLC plates)	1
	GLASSWARE	
5	Petriplate (90mm)	50
6	Beakers (100ml)	5
	Beakers (250ml)	2
	Beakers (500ml)	1
7	Measuring Cylinder (10ml)	1
	Measuring Cylinder (50ml)	1
	Measuring Cylinder (100ml)	1
8	Reagent Bottle (500ml)	1
9	Conical flask (500ml)	4
	Conical flask (250ml)	4
	Conical flask (100ml)	10
10	Pipettes (10ml)	2
	Pipettes (5ml)	2
11	Separating funnel (250ml)	2
12	Funnel (100mm)	1
	Funnel (65mm)	2
13	Test tubes (18x150mm)	50
	Test tubes (25x150mm)	25
14	Glass rods	2
	PLASTICWARE	
15	Beaker (1000ml)	1
16	Measuring Cylinder (500ml)	1
17	Micropipette tips (1000 µl)	1 pack
	Micropipette tips (200 µl)	1 pack
	Micropipette tips (20 µl)	1 pack
18	Vials (2ml)	1 pack
19	Centrifuge tubes (15ml)	10 nos

	CHEMICALS	
1	Potato dextrose broth (Himedia 500g)	1
2	MRS broth (Himedia 500g)	1
3	Agar (Himedia 500g)	1
4	Peptone (Himedia 100g)	1
5	Yeast extract (Himedia 100g)	1
6	Dextrose (500g)	1
7	Sucrose (500g)	1
8	Sodium chloride (500g)	1
9	Monopotassium phosphate (100g)	1
10	Magnesium Sulphate (100g)	1
11	Rose Bengal (10g)	1
12	Streptomycin (10g)	1
13	Sodium hydroxide (100g)	1
14	Ethanol (1000ml)	1
15	Chloroform (500ml)	1
16	Glacial acetic acid (500ml)	1
17	Dimethyl Sulphoxide (DMSO- 100ml)	1
18	Butanol (500ml)	1
19	Lactophenol Cotton Blue (100ml)	1
20	Grams staining kit	1
21	Standard Aflatoxin B1 (Sigma- A6636- mg)	1
22	Cedar wood oil/ immersion oil (10ml)	1
	OTHERS	
1	Cotton	2 rolls
2	Muslin Cloth	2 nos
3	Blotting paper	10 sheets
4	Whatmann No 1 filter paper	1 box
5	Butter paper sheets	10 sheets
6	Aluminium foil	2 rolls
7	Inoculation loop	1
8	Needles	4
9	Microscope slides	1 box
10	Cover slips	1 box
11	pH paper	1 box
12	Forceps	3
13	Spatula	3
14	Clean wrap/Fresh wrap	2
15	Latex Gloves	1 box
16	Plastic tray	2
17	Rubber bands	1 pack
18	Labels	1 pack

5.6 Progress status (if any): Nil

12/11/2020

Head of the Department
MICRO BIOLOGY
M.S. Ramaiah College of Arts
Science & Commerce
Bangalore - 560 054

12/11/2020

M.S Ramaiah College of Arts, Science and Commerce (M.S.R.C.A.S.C)

SEED MONEY PROJECT

PROGRESS REPORT AS ON 17th September, 2021

1. Name of PI: **Dr. Vasanth Kumar Bhaskara**, RASC, Bengaluru
2. Name of Co-PI: Prof. Vijaya V. Mysorekar, RMCH, Bengaluru
3. Fund Sanctioned: 1,50,000Rs.
4. Title of the Project: "Molecular Characterization of Cancer Stem Cell Mediated Drug Resistance in Triple Negative Breast Cancer (TNBC)"
5. Requirments Procured:

1. Anti-Prominin-1 Polyclonal Antibody (AbcamCat#PAB12663): 33,667.00 Rs.
2. Phospho-AMPK Rabbit mAb (CST Cat#2535S): 43,518.00 Rs.
3. LC3B Rabbit mAb (CST Cat# 43566S): 38,209.00 Rs.

TOTAL: 1, 14,903.00

Remaining: 1,50,000 – 1,14,903 = **35,097.00**Rs.

Pending Dues: To Pathology Dept., RMCH for secondary antibody used; Technician support & Microscopy charges (Invoice Yet to receive)

6. Students Worked on the Project: AISHWARYA NITIN KAMBKE (BC190001) (2019-21 Batch) ASHWIN M (BC190003)
POOJA SREE REDDY (BC190007)

7.Methods Used: 1. TNBC FFPE Sample Selection for study (10 Samples)
2. Tissue processing &Sectioning by using microtone (at RMCH)
3. Microscopic slide preparation for immunohistochemistry
4. Haematoxylin & Eosin (H&E) staining
4. Immunohistochemistry (Ki67; CD133; pAMPK; LC3B)

8. Results & Discussion:

a) Patient Sample Details:

This project includes the same methodology proposed in earlier ethical clearance obtained and same is applicable.

#	Age (years)	Ki-67 index (%)	Menopausal status	Family history
S1	44	80%	Pre-menopausal	No history of malignance
S2	41	90%	Pre-menopausal	Present in second degree relative
S3	48	50%	Post-menopausal	Present in first and second degree relative
S4	48	20%	Post-menopausal	No history of malignance
S5	45	20%	Pre-menopausal	No history of malignance
S6	61	15%	Post-menopausal	No history of malignance

*Source: Department of Pathology, RMCH

This is a retrospective study by collecting achieved FFPE samples from the library of pathology department, RMCH.

b) H&E Staining:

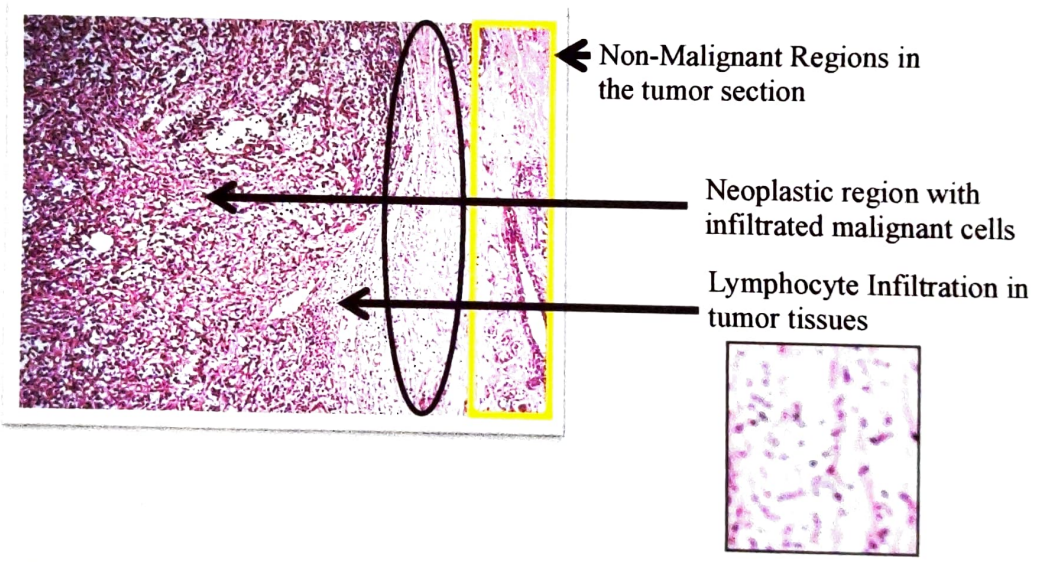


Figure: Haematoxylin & Eosin (H & E) micrograph (100 x) of bright-field microscopy image representing four TNBC samples showing characteristic morphological features of TNBC

c) ER/PR/HER2 status:

The current project focuses CSC drug resistance screening in triple negative breast cancer and hence, tissue sections used are confirmed to be $ER^-/PR^-/HER2^-$.

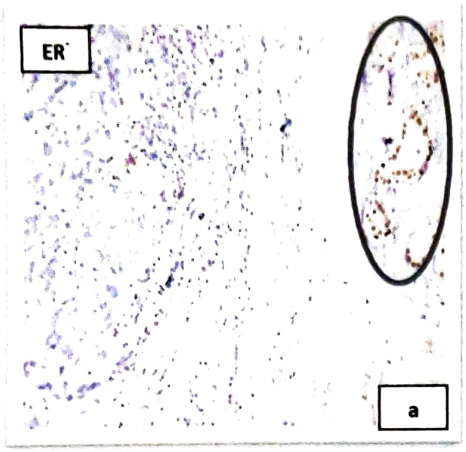


Figure (a): ER Negative–Immunohistochemistry of Estrogen receptor status in malignant regions of the section is completely negative (ER^-) and same section has shown positivity in circled non-malignant regions

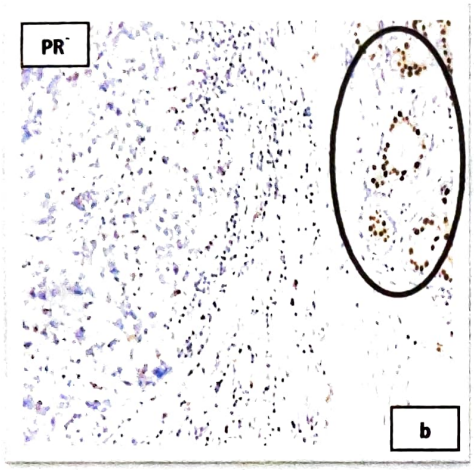


Figure (a): PR Negative–Immunohistochemistry of Estrogen receptor status in malignant regions of the section is completely negative (PR^-) and same section has shown positivity in circled non-malignant regions

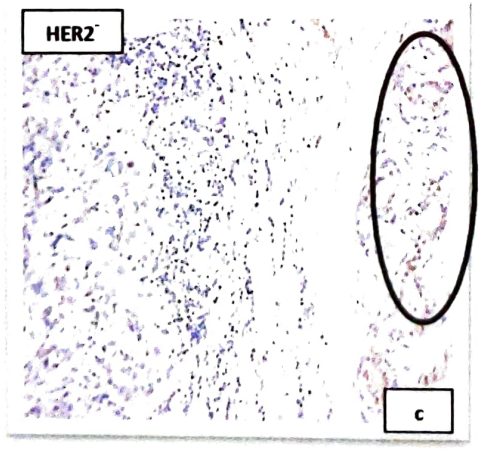


Figure (c): HER2 or Neu Negative–Immunohistochemistry of Estrogen receptor status in malignant regions of the section is completely negative ($HER2^-$) and same section has shown very feeble positive cells in the circled non-malignant regions of the section.

d) Ki67 labeling:

Ki67 is a nuclear marker which has been shown to be correlated with the disease aggressiveness or patient survival and with number of Ki67 positive nuclei in the

section. This is an established marker to assess the TNBC prognosis and aggressiveness.

This marker expression is further correlated with CD133 and pAMPK positivity in the TNBC sections of the same patients.

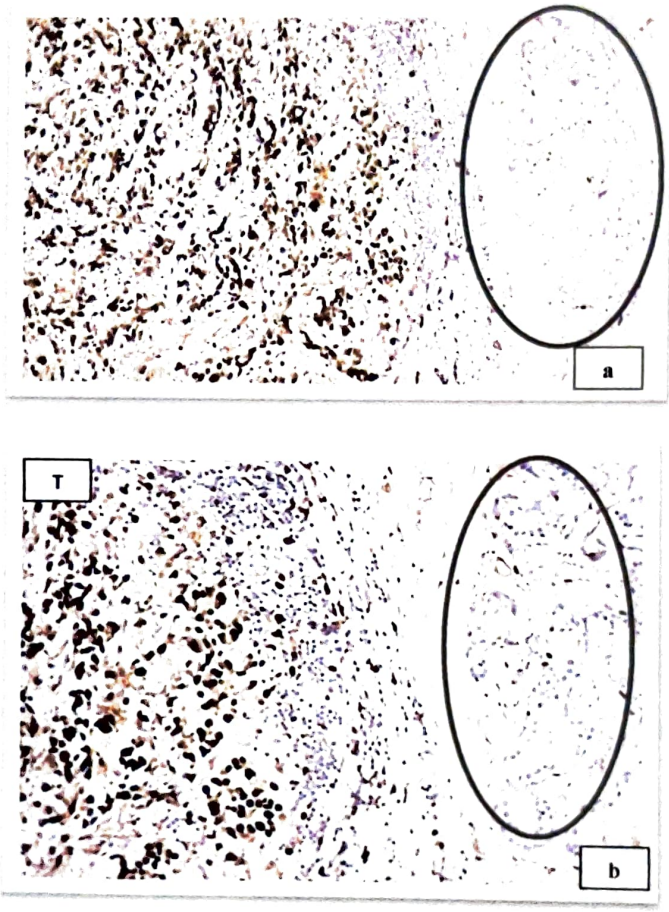


Figure: Immunohistochemistry of Ki67 - Representative Immuno-histochemical micrographs 100 x (a & b) of breast tumor tissues (S1, S2, S3, S4, S5, S6) indicating a) non-malignant regions of the section with feeble Ki67 positivity; b) high nuclear positivity for Ki67 marker in tumor region and lower positivity in non-malignant encircled tumor region.

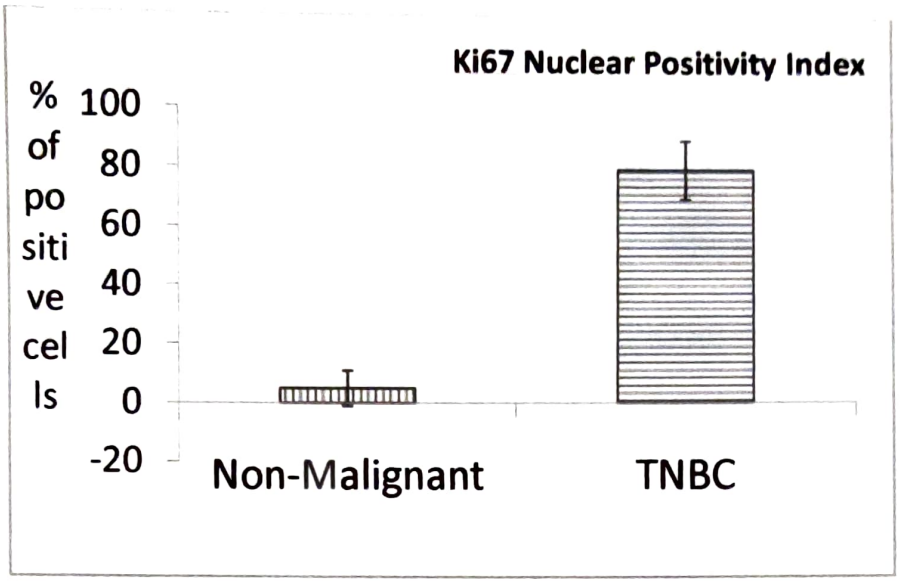


Figure: Ki67 IHC Graph- Graphical representation of Mean ± SD of number of Ki67 positive cells counted in 10 different microscopic fields of the sections

e) **IHC of CD133VspAMPK**:

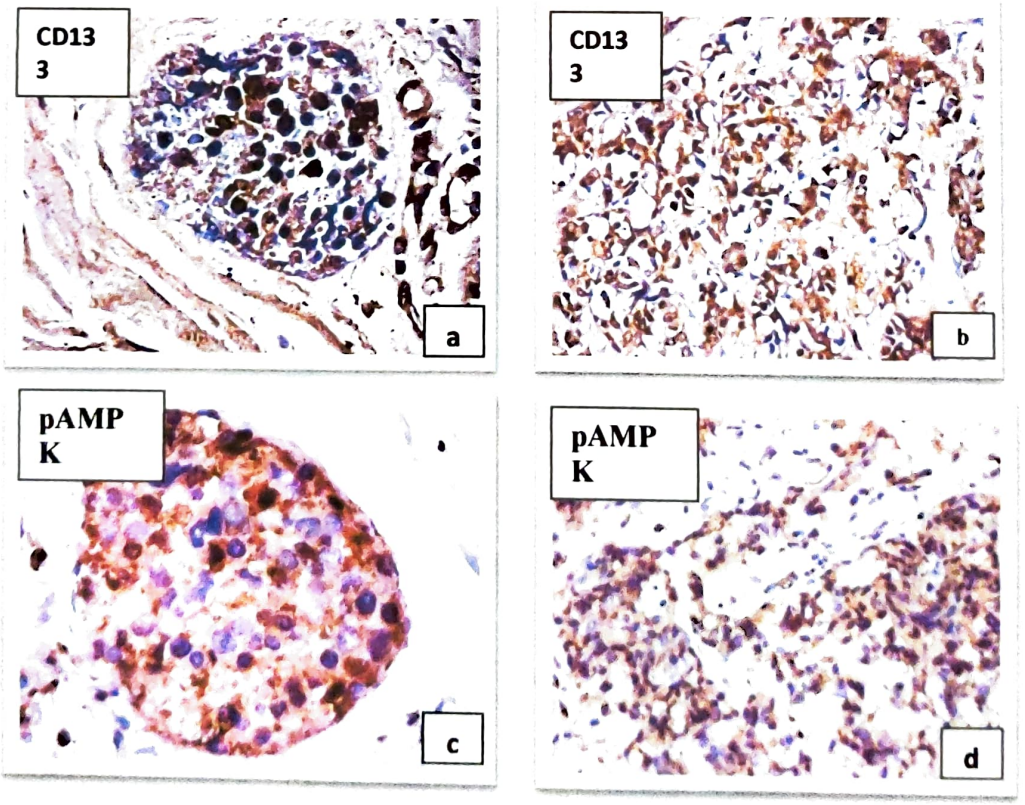
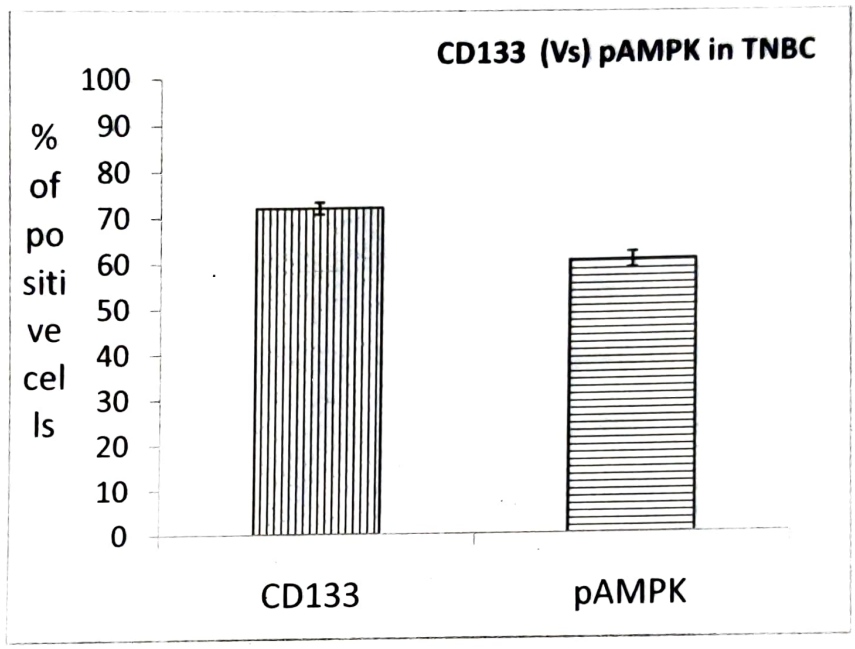


Figure:CD133 (Vs) pAMPK - Representative immunohistochemical micrograph of breast cancer tissues (S1, S2, S3, S4, S5, S6) indicates a) cytosolic positive stain for CD13 expression in tumor cells under higher magnification 400 x; b) CD133 expression in tumor cells under lower magnification 200 x; c) nuclear positive stain for pAMPK expression in tumor cells under higher magnification 400 x; d) pAMPK expression in tumor cells under lower magnification 200 x;



CONCLUSIONS:

1. The number positive Ki-67 nuclei in malignant region represented mean 79% over the 5% in non-malignant regions of the sections.
2. The number positive CD133 and pAMPK cells in malignant region represented mean 72% and 60% respectively.
3. This study indicates a possible relation between Ki-67, CD133 and pAMPK suggesting the association of cancer stemness and drug resistance in indian TNBC patients.

Future Directions of the current project:

1. Total **35, 097.00 Rs**is remaining from the sanctioned grant. This is good enough to check LC3B which is a autophagy marker at transcript level by RT-PCR. This is possible if RMCH can waive off the charges, as RCASC is a sister institute and to encourage research in the campus. Transcript analysis in TNBC further can improve the impact of the study so that work can be published in good impact journals.

2. In vivo studies are essential to substantiate and to check the effects by targeted inhibitors of respective signaling cascades.

17/09/2021

(Dr. Vasanth Kumar Bhaskara Ph.D)

PI of the Project

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College of Arts, Science
& Commerce

Department of Chemistry & Biochemistry

Date: **17/09/2021**

Progress Report

Title: **Synthesis of Inorganic-Organic Hybrid materials and their application for the degradation/ adsorption of organic pollutants**

PI: Dr Asha K S

Co-PI: Prof. Prasanna Kumar S G

Introduction: Water pollution is one of the most serious problems that threatens the survival and development of human society worldwide. Thus, it is imperative to find answers to effectively remove contaminants from water sources. As a fast-growing branch of coordination chemistry, inorganic – organic hybrid materials tailorable porous structures and numerous active sites have proved to be ideal adsorbents or photocatalysts for water purification.

In the on-going project we selected a Zirconium-based Metal-Organic Framework like UiO-type MOFs since they are known to be very much stable in aqueous medium. The post synthetic modification is one of the best tools to tailor properties of conventionally synthesized MOFs. The whole plan of the project is to synthesize a Zirconium based MOF followed by post synthetic modification to graft boronic acid into the framework for selective adsorption of cis-diols.

Hydroxy aromatic compounds (e.g., catechol, resorcinol, and hydro- quinone) are compositions of industrial effluents in fields including textile, pulping and papermaking, steel production, petrochemical, rubber, petroleum refinery, plastics, dye, cosmetics, pharmacy, and so forth. They are also found from wastewater released from synthetic conversion processes of coal fuel. Especially, Catechol with concentrations of 1−1000 mg/L is probably contained in effluents from synthetic conversion processes of coal fuel. Compared to other hydroxy aromatic compounds, catechol has higher toxicity and is found to have implications to DNA damage, and collapse of blood vessels. We selected one type of Zirconium-based MOF, called as UiO-66 which is having relatively high surface area and can be easily modified to facilitate high adsorption.

The grant was sanctioned in the month of October 2020. The purchase of chemicals and equipment was initiated in the month of January 2021 and all the items were received in February 2021 (details have been submitted to the finance section).

The synthesis of MOF was carried out in the beginning of March 2021 and the primary characterizations like PXRD, IR, etc. were completed at IISc. The boronic acid grafted MOF (B-UiO-66) was synthesized solvothermally (detailed procedure is given below). The same was checked for phase purity and dried samples were used for Catechol adsorption studies.

Problems Encountered: The plan was to monitor the adsorption of catechol by using UV-Visible spectroscopy, but unfortunately, we could not get good results due to the rapid oxidation to catechol and therefore, aliquots collected at different time intervals didn't give consistent UV spectra. Our new plan is to study the adsorption of catechol by boronic acid grafted UiO-66 through N_2 adsorption studies of MOF before and after adsorption of catechol. The surface area of the MOF will be measured for each sample.

Synthesis of MOF

Materials:

1. Zirconium oxychloride ($ZrOCl_2.8H_2O$)
2. Terephthalic acid
3. 4-carboxyphenylboronic acid
4. Acetic acid
5. DMF (Dimethylformamide) – solvent

Procedure: Mixed-ligand approach was implemented

UiO-66: 45.11 mg (0.14 mmol) of $ZrOCl_2.8H_2O$ was weighed into a glass beaker and dissolved in 5mL of DMF and stirred for 15 minutes, to this 0.7 mL of acetic acid was added and continued to stir for another ten minutes. This mixture was kept aside and then 24.88 mg (0.15 mmol) of Terephthalic acid was weighed to another glass beaker and dissolved it in 5 mL of DMF solvent and stirred the mixture for five minutes. Both the mixtures are then mixed well and taken in a 25 mL Teflon lined Autoclave. It was heated at 120 ^{0}C in a hot air oven for 24 hrs. The MOF was formed in the form of white colored gel. This latter was washed with DMF two times and Ethanol three times and dried in oven at 200 ^{0}C for overnight. The as-synthesized MOF was used for analysis.

B-UiO-66: 45.11 mg (0.14 mmol) of $ZrOCl_2.8H_2O$ was weighed into a glass beaker and dissolved in 5mL of DMF and stirred for 15 minutes, to this 0.7 mL of acetic acid and 24.88 mg (0.15 mmol) of 4-Carboxyphenylboronic acid were added and continued to stir for another ten minutes. This mixture was kept aside and then 24.88 mg (0.15 mmol) of Terephthalic acid was weighed to another glass beaker and dissolved it in 5 mL of DMF solvent and stirred the mixture for five minutes. Both the mixtures are then mixed well and taken in a 25 mL Teflon lined Autoclave. It was heated at 120 ^{0}C in a hot air oven for 24 hrs. The MOF was formed in the form of white colored gel. This latter was washed with DMF two times and Ethanol three times and dried in oven at 200 ^{0}C for overnight. The as-synthesized MOF was used for analysis.

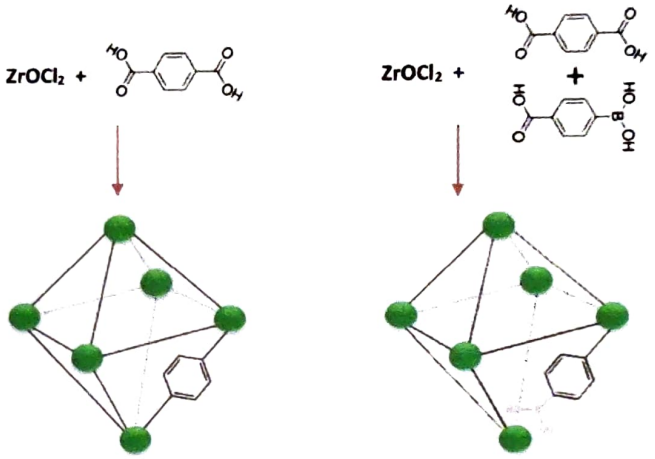

Figure 1: Schematic of synthesis route of UiO-66 and Boronic acid grafted UiO-66 MOFs

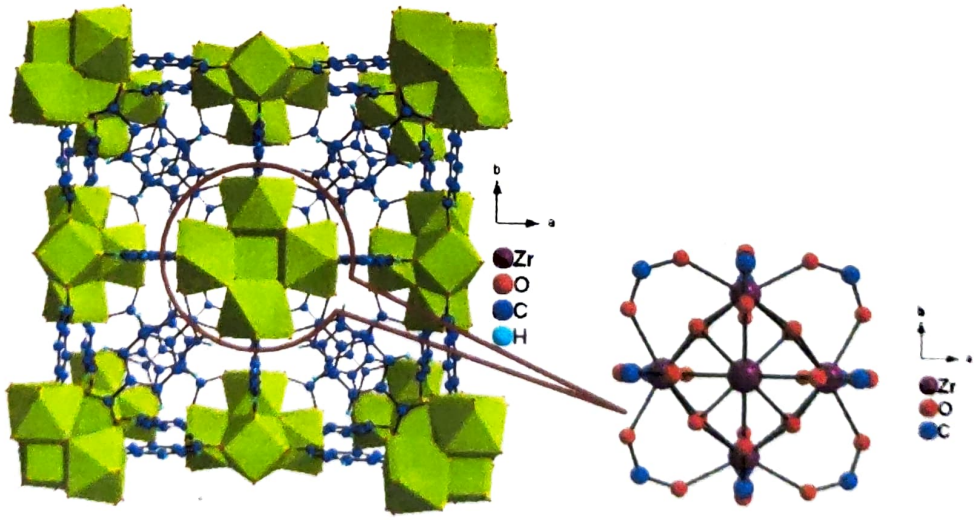

Figure 2: Structure of UiO-66 MOF

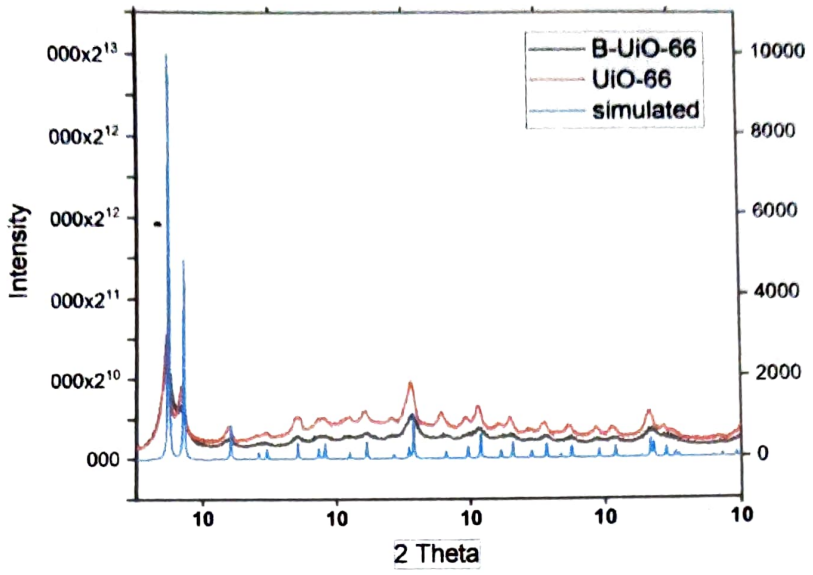

Figure 3: PXRD Analysis of UiO-66 and Boronic acid grafted UiO-66 MOFs

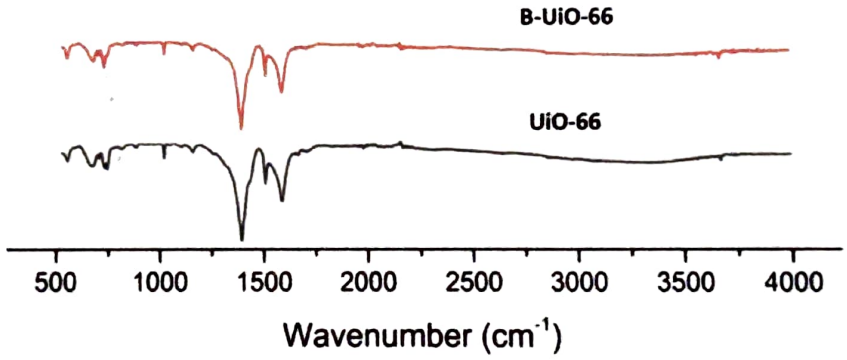

Figure 4: IR Spectra of UiO-66 and Boronic acid grafted UiO-66 MOFs

The Powder X-Ray Diffraction (PXRD) analysis of as-synthesized MOFs was done for checking their purity. It was evidenced that the XRD peaks of both UiO-66 and B-UiO-66 are exactly matching with simulated pattern extracted from their cif file.

Future Plans:

- Measurement of N_2 adsorption studies of MOF before and after catechol adsorption to calculate surface area and pore volume
- B^{11}-NMR spectra of B-UiO-66
- Thermogravimetric Analysis of MOF before and after adsorption of catechol

- Quantification of catechol adsorption

The above characterizations will be carried out at IISER Thiruvananthapuram and IISc Bangalore.

17/9/24

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Department of Biotechnology and Genetics

Progress Report on Seed Money Project

December 2020 to May 2021 (Report 1)

Project Title: Study and Evaluation of *Cymbopogon* species on Methicillin-Resistant *Staphylococcus aureus* (MRSA).

Introduction:

Cymbopogon, is commonly known as Cochin grass, Malabar grass, lemongrass, barbed wire grass, silky heads, oily heads, citronella grass or fever grass. Cymbopogon belong to the grass family and is native to Asia, Africa, Australia, and tropical islands [1][2][3][4]. The name *Cymbopogon* is derived from the Greek words kymbe means 'boat' and pogon refers to 'beard' which mean, hairy spikelets projected from boat-shaped spathes in most species."[5]. Species of Cymbopogon such as *Cymbopogon citratus* and *Cymbopogon flexuosus* are commonly used in culinary purposes because of their lemon scent. The genus is used as medicinal herbs due to their anti-depressant, analgesic, antipyretic, bactericidal, antiseptic, carminative and astringent properties [6].

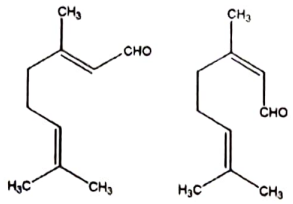
Cymbopogons, a member of poaceae family exhibit medicinal properties due to compounds capable of controlling pathogens and increases herbal resistance to pathogenic diseases. Lemongrass is widely used in the herbal teas and other non-alcoholic beverages in baked food, and also in the confections [7]. Essential oil from the lemongrass is commonly used as a fragrance in the perfumes and cosmetics, such as creams and soaps. Lemon grass essential oil is comprised of a high content of citral, which is used as a source for the production of beta carotene and vitamin A [8] [9] [10]. Steam distillation is used to recover volatile compounds with a high boiling point, from inert and complex matrices, solid or liquid, using saturated or superheated steam as separation and energy agent. This process has been widely used for the extraction of essential oil from plants.

Secondary Metabolites: Most of the metabolites produced by plants are polysaccharides and proteins that give the plants structure and function. Plants also produce small amounts of secondary metabolites: compounds that are not directly related to growth or reproduction. Many of these secondary metabolites are very commercially valuable and some have very complex chemistry. Most of the plant compounds used in perfumes, flavors, and natural medicines are secondary metabolites.

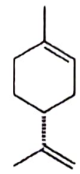
Terpenes and Terpenoids

One of the key secondary metabolite building blocks is a five carbon molecule called isoprene (or, more officially, 2-methyl-1,3-butadiene). Isoprene is used by plants to produce terpenes, molecules made from 2 or more isoprenes, and terpenoids, terpenes that have slight chemical

modifications, especially terpene alcohols. Terpenes and terpenoids are the chemical compounds responsible for many plant smells and flavors. Pine trees produce a large number of terpenes and the solvent turpentine was originally derived from pine tree resin.



Citral



D-limonene

Terpenes may be classified by the number of isoprene units in the molecule. Monoterpenes consist of two isoprene units and have the molecular formula C10H16. Limonene, the smell of citrus, is a monoterpene. Sesquiterpenes consist of three isoprene units and have the molecular formula C15H24. Farnesol, is an alcohol sesquiterpenoid that is responsible for floral smells like roses. Diterpenes consist of four isoprene units and are precursors for many important biological molecules with anti- inflammatory, antimicrobial and anti-cancer properties. Retinol, aka Vitamin A, is a diterpenoid. Triterpenes consist of six isoprene units. Squalene is a triterpene that organisms use to make cycloartenol, the precursor to steroids. Tetraterpenes contain eight isoprene units and include antioxidants lycopene and beta-carotene. Polyterpenes are even longer chains of isoprene units. Natural rubber is a polyterpene [11].

Methicillin Resistant *Staphylococcus aureus* (MRSA) is a multidrug resistant bacterium not only resistant to β-lactam antibiotics, but also to other antimicrobial agents such as aminoglycosides, quinolones, and macrolides [12]. MRSA infections are of 2 types such as Community associated and Healthcare associated infections. In the Community associated infections, MRSA most often causes skin infections. In some cases, it causes pneumonia and other infections. If it is left untreated, MRSA infections can become severe and cause sepsis (body's extreme response to an infection). In Healthcare associated infections (hospital and nursing homes), MRSA can cause severe problems such as Bloodstream infections, Pneumonia or Surgical site infections [13]. The risk increases with activities or places that involve crowding, skin-to-skin contact, and shared equipment or supplies. Non-intact skin, such as when there are abrasions or incisions, is often the site of an MRSA infection. Athletes, daycare and school students, military personnel in barracks, and those who receive inpatient medical care or have surgery or medical devices inserted in their body are at higher risk of MRSA infection [14].

One of the MRSA isolate was resistant to all the antibiotics used (cefoxitin, oxacillin, ciprofloxacin, erythromycin, tetracycline, ampicillin, streptomycin and sulfamethoxazole-trimethoprim). Five of the MRSA isolates were multi-drug resistant, whilst the other three were resistant to only two antibiotics. Studies have found that genetic mutations in MRSA allow it to evolve and become more resistant to antibiotics such as penicillin. However in some reports

ampicillin and penicillin G were shown to have relatively good activity against MRSA if combined with a beta-lactamase inhibitor, sulbactam [15].

Vancomycin continues to be the drug of choice for treating most MRSA infections caused by multi-drug resistant strains. Clindamycin, co-trimoxazole, fluoroquinolones or minocycline may be useful when patients do not have life-threatening infections caused by strains susceptible to these agents. For serious infections caused by strains that are susceptible to rifampin, adding this agent to vancomycin or fluoroquinolone may contribute to improved outcomes. Rifampin should not be used alone to treat MRSA infections due to the rapid development of resistance [16]. The infecting strain always should be tested for susceptibility prior to initiating any of these therapies.17 The two newest antimicrobials, quinupristin-dalfopristin (Synercid®) and linezolid (Zyvox™), are effective for MRSA infections, although routine use is generally discouraged to prevent further resistance to these agents. Other investigational agents are in research stages but not yet approved for use. Most strains of MRSA are inhibited by concentrations of vancomycin ranging from 0.5-2.0 mcg/mL, although strains have been reported with intermediate sensitivity (MIC=8 mcg/mL) that have been called glycopeptide-intermediate *Staphylococcus aureus* (GISA) or vancomycin-intermediate *Staphylococcus aureus* (VISA). 19 Such infections are likely to be seen with increasing frequency, particularly among patients who receive prolonged courses of vancomycin or have risk factors for acquiring MRSA [17].

Studies on Lemongrass essential oil and its bioactive component citral have demonstrated strong antimicrobial efficacy against pathogenic bacteria including *S. aureus* and fungi. Studies showed that alpha citral (Geranial) and beta citral (Neral) showed antimicrobial activity against Gram-positive and Gram-negative bacteria. Lemongrass is used as a natural remedy to heal wounds and help prevent infection [18].

Objectives:

1) Collection of Plant samples.

2) Extraction of essential oil and analysis

Materials and Methods:

1) Procurement of chemicals:

The chemicals required to initiate the research work were listed and quotations were collected from 3 different dealers. Through comparative statement, the lowest quoted quotation was considered and chemicals were procured.

2) **Procurement of instrument:**

Clevenger's apparatus (Glass instrument) required for hydrodistillation of essential oil was procured from Vasa Scientific Co.

3) **Collection of plant material:** Different species of *Cymbopogon* and its varieties were collected from Gandhi Krishi Vignana Kendra GKVK), Bengaluru.

The following are the different species of *Cymbopogon* and its cultivars collected from Department of Horticulture, GKVK.

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a) *Cymbopogon flexuosus* (Lemongrass).

Cultivars: Pragathi, CKP-25, Krishna, OD-19, Cauvery

b) *Cymbopogon martinii* (Palmarosa).

c) *Cymbopogon winterianus* (Citronella).

The herbage is cut into small pieces measuring up to 3cm and air dried at room temperature. The plant material is stored in polythene bags for further studies.

4) **Extraction of essential oil from *Cymbopogon flexuosus* and *Cymbopogon winterianus*.**

Steam distilled essential oils of *Cymbopogon flexuosus* and *Cymbopogon winterianus* were extracted at Horticulture department, GKVK. Fig 1
Steam is used as an extracting agent to vaporize or liberate the volatile compounds from the raw material. The compounds are volatilized by absorbing heat from the steam and are then transported to the steam by diffusion in it. The resulting vapour phase is cooled and condensed prior to separating the water from the organic phase based on their immiscibility. In this process, two products are obtained: volatile oil and hydrosol. The volatile oil is in the upper phase and the hydrosol (water and some hydrolysed compounds) is in the bottom phase of the decanter. According to the type of contact between the matrix and water and/or steam, there are three variants of the steam distillation process.

5) **Essential oil analysis:**

Steam distilled essential oil of *Cymbopogon flexuosus* and *Cymbopogon winterianus* were subjected to Gas Chromatography and Mass Spectroscopy (GCMS) analysis.

GC-MS analysis was performed on a Thermo GC-trace ultra ver: 5.0, Thermo MS DSQ II using DB 5-MS Capillary Standard Non-Polar Column (30mts×0.25mm×0.25µm). The

temperature program was 70°C (6 min) rising to 260°C at a rate of 60°/min. Injector and detector temperature was 260°C. Helium was used as carrier gas at a flow rate 1.0ml/min. Identification of the compounds was carried out by comparison of the mass spectral fragmentation patterns with those stored in MS database (National Institute of Standards and Technology).

6) Collection of Methicillin Resistant *Staphylococcus aureus* (MRSA) isolates:

Five MRSA isolates were collected from Ramaiah Memorial Hospital and they were preserved by using glycerol stock (10%) for further studies at deep freeze conditions.

Result and Discussion:

GCMS analysis:

Steam distilled essential oil of *Cymbopogon flexuosus* and *Cymbopogon winterianus* subjected to GCMS analysis showed 54 compounds and 47 compounds respectively. The essential oil compounds are listed in Table 1. The important compounds found in steam distilled essential oil of *Cymbopogon flexuosus* are E-Citral (32.14%), Z-Citral (8.83%), Camphene (0.09%), D-Limonene (2.14%), 4-Nonanone (0.16%), Isopulegol (0.45%), 2-Octen-1-ol, 3,7-dimethyl-(8.64%), Thujone (0.05%), 6-Octen-1-ol, 3,7-dimethyl-, acetate (3.26%), Caryophyllene (1.09%), alpha.-Caryophyllene (0.19%), 1,6-Cyclodecadiene, 1-methyl-5-methylene-8-(1-methylethyl)-, [s-(E,E)]- (0.88), Cubenol (0.05), alpha.-Muurolene (0.31%), Cyclohexanemethanol and Caryophyllene oxide(0.17%).

The secondary metabolites found in steam distilled essential oil of *Cymbopogon winterianus* (Table 2) are D-Limonene (2.38%), 1,6-Octadien-3-ol, 3,7-dimethyl-(0.70%), Isopulegol (2.98%), 6-Octenal, 3,7-dimethyl-(15.25%), Isopulegol (2.94%), 2-Octen-1-ol, 3,7-dimethyl-(5.38%), 2,6-Octadienal, 3,7-dimethyl-, (Z)- (0.32%), 2,6-Octadien-1-ol, 3,7-dimethyl-, (E)- (11.83%), 2,6-Octadienal, 3,7-dimethyl-, (E)- (0.40%), Cyclohexanol, 2-(2-hydroxy-2-propyl)-5-methyl- (1.21%), 6-Octen-1-ol, 3,7-dimethyl-, acetate (3.31%), Cyclohexanol, 2-(2-hydroxy-2-propyl)-5-methyl- (0.73%), 2,6-Octadien-1-ol, 3,7-dimethyl-, acetate, (E)- (5.94%), Cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methylethenyl)-, [1S-(1.alpha.,2.beta.,4.beta (1.00%), Naphthalene, 1,2,3,4,4a,5,6,8a-octahydro-7-methyl-4-methylene-1-(1-methylethyl)-, (1.a(0.22%), 1,6-Cyclodecadiene, 1-methyl-5-methylene-8-(1-methylethyl)-, [s-(E,E)]- (1.50%), alpha.-Muurolene (0.25%),Cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methylethenyl)-, [1S-(1.alpha.,2.beta.,4.beta (0.33%), Naphthalene, 1,2,3,4,4a,5,6,8a-octahydro-7-methyl-4-methylene-1-(1-methylethyl)-, (1.a (0.58%), Naphthalene, 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-, (1S-cis)- (1.87%), Cyclohexanemethanol, 4-ethenyl-.alpha.,.alpha.,4-trimethyl-3-(1-methylethenyl)-, [1R-(2.57%), 2-Naphthalenemethanol, 1,2,3,4,4a,5,6,7-octahydro-.alpha.,.alpha.,4a,8-tetramethyl-, (0.39%), tau.-Cadinol $$ 4-

Isopropyl-1,6-dimethyl-1,2,3,4,4a,7,8,8a-octahydro-1-naphthalenol (0.68%), 2-Naphthalenemethanol, 1,2,3,4,4a,5,6,8a-octahydro-.alpha.,.alpha.,4a,8-tetramethyl-, (1.50%), 6-Octenal, 3,7-dimethyl- (1.66%), (1-Bromo-1-methyl-ethyl)-2-methyl-cyclohexanol (0.26%), (1-Bromo-1-methyl-ethyl)-2-methyl-cyclohexanol (0.37%), Naphthalene, 2-decyldecahydro-(0.58%), Bicyclo[3.3.1]nonan-9-one, 2,4-dimethyl-3-nitro- (exo)-(0.29%), Diazoacetic acid, 2-isopropyl-5-methylcyclohexyl ester (0.39%),1,5,9-Decatriene, 2,3,5,8-tetramethyl-(1.47%), 1,5,9-Decatriene, 2,3,5,8-tetramethyl-(0.52%),2,6,6,9,2',6',6',9'-Octamethyl-8,8']bi[tricyclo[5.4.0.0(2,9)]undecyl](0.18%), Bicyclo[3.3.1]nonan-9-one, 2,4-dimethyl-3-nitro- (exo)- (0.15%), Phosphonous dichloride, (1,7,7-trimethylbicyclo[2.2.1]hept-2-yl)- (0.20%), Crotonic acid, menthyl ester (1.81%), Farnesol isomer a (9.22%), Squalene (12.44%), Dodecanoic acid, 1,2,3-propanetriyl ester (0.58%), 11-Oxatricyclo[5.3.0.1(2,6)]undecan-4-one, 3-endo-5-endo-dimethyl-9-isopropylidene-(0.52%), 3.beta.-Myristoylolean-12-en-16.beta.-ol(0.65%), Allopregnane-3.alpha.,20.alpha.-diol (0.46%), Dodecanoic acid, 1,2,3-propanetriyl ester (0.19%), Heneicosane, 3-methyl- (0.25%), beta.-Myristoylolean-12-en-16.beta.-ol (2.40%). The results are in accordance with studies conducted by Hong Wu et al., 2019 and H. J. Zhang et al., 2017 [19][20] on *C.winterianus.* The chromatogram of the *Cymbopogon flexuosus* and Cymbopogon winterianus is given in the Fig:1 and 2 respectively.

MRSA Test Cultures:

Due to Covid-19 pandemic and second lockdown, the bacterial MRSA cultures stored in refrigerator had lost its viability (as they had to be used within four weeks of collection) and hence MRSA cultures could not be used for further studies.

Conclusion:

Species of Cymbopogon were collected, air dried at room temperature and stored for further studies. Steam distilled essential oil of 2 species of Cymbopogon viz *C.flexuosus and C. winterianus* were subjected to GCMS analysis which revealed the presence of commercially important compounds. The results are as expected and further studies include hydrodistillation of essential oil using Clevengr's apparatus from cultivars of *C.flexuosus* and *C.martinii* and extraction of plant secondary metabolites through Soxhlet apparatus.

Figures and Tables:

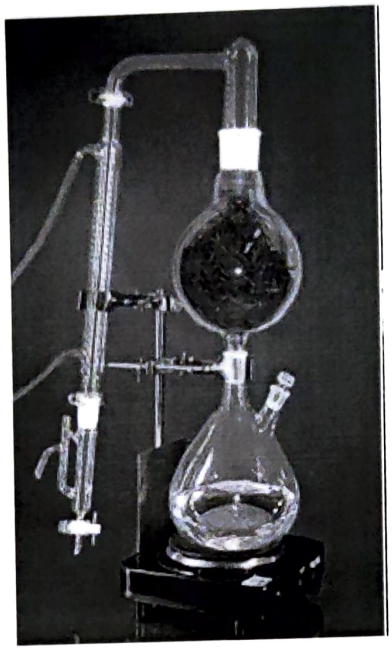

Fig: 1 : Steam distillation unit

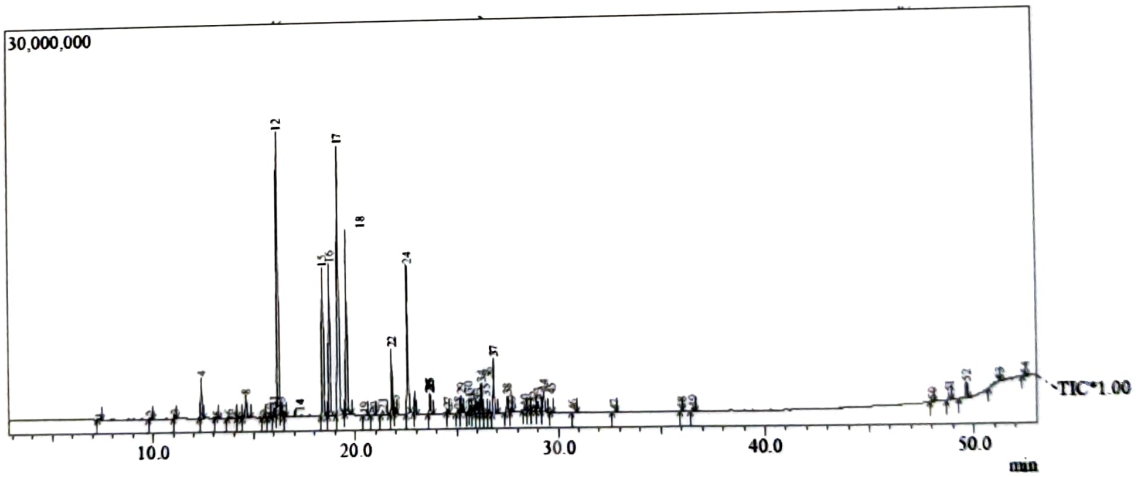

Fig 2: Chromatogram of *C.flexuosus* essential oil

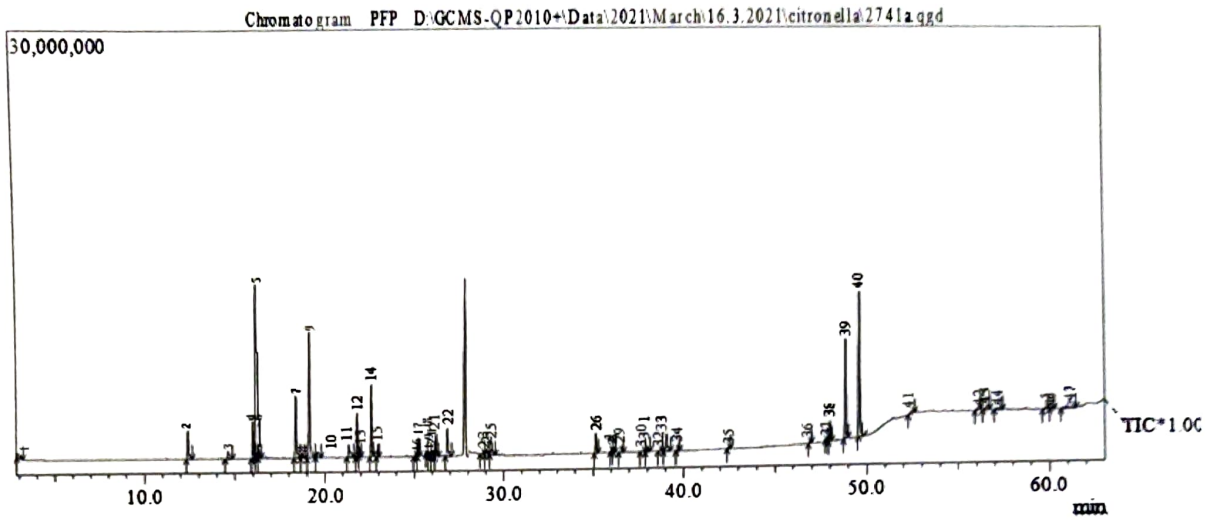

Fig 3: Chromatogram of *C.winterianus* essential oil

Table 1: List of essential oil compounds *C.flexuosus*

Peak	Name	Area %
1	Cyclopentane, 1-methyl-3-(1-methylethyl)-	0.05
2	Camphene	0.09
3	5-Hepten-2-one, 6-methyl-	0.17
4	D-Limonene	2.14
5	5-Heptenal, 2,6-dimethyl-	0.04
6	4-Nonanone	0.16
7	Cyclohexene, 1-methyl-4-(1-methylethylidene)-	0.05
8	1,6-Octadien-3-ol, 3,7-dimethyl-	1.27
9	2-Octen-1-ol, 3,7- dimethyl-	0.04
10	Cyclohexanone, 5-methyl-2-(1-methylethylidene)-	0.05
11	Isopulegol	0.41
12	6-Octenal, 3,7-dimethyl-	18.55
13	Bicyclo[3.1.1]hept-3-en-2-ol, 4,6,6-trimethyl-, [1S-(1.alpha.,2.beta.,5.alpha.)]-	0.19
14	2-Octen-1-ol, 3,7-dimethyl-	8.64
15	2,6-Octadienal, 3,7-dimethyl-, (Z)-	8.83
16	2,6-Octadien-1-ol, 3,7-dimethyl-, (E)-	20.86
17	2,6-Octadienal, 3,7-dimethyl-, (E)-	11.28
18	1,6-Octadien-3-ol, 3,7-dimethyl-, formate	0.05
19	Thujone	0.05
20	Cyclohexanol, 2-(2-hydroxy-2-propyl)-5-methyl-	0.23
21	6-Octen-1-ol, 3,7-dimethyl-, acetate	3.26
22	Phenol, 2-methoxy-3-(2-propenyl)-	0.27

23	2,6-Octadien-1-ol, 3,7-dimethyl-, acetate, (E)-	8.02
24	Cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methylethenyl)-, [1S-(1.alpha.,2.beta.,4.beta	1.15
25	Caryophyllene	1.09
26	alpha.-Caryophyllene	0.19
27	Naphthalene, 1,2,3,4,4a,5,6,8a-octahydro-7-methyl-4-methylene-1-(1-methylethyl)-, (1.a	0.14
28	1,6-Cyclodecadiene, 1-methyl-5-methylene-8-(1-methylethyl)-, [s-(E,E)]-	0.88
29	Cubenol	0.05
30	alpha.-Muurolene	0.31
31	Cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methylethenyl)-, [1S-(1.alpha.,2.beta.,4.beta	0.43
32	Naphthalene, 1,2,3,4,4a,5,6,8a-octahydro-7-methyl-4-methylene-1-(1-methylethyl)-, (1.a	0.69
33	Naphthalene, 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-, (1S-cis)-	1.55
34	Hexanoic acid	0.06
35	Naphthalene, 1,2,4a,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-, [1S-(1.alpha.,4a	0.08
36	Cyclohexanemethanol, 4-ethenyl-.alpha.,.alpha.,4-trimethyl-3-(1-methylethenyl)-, [1R-(	2.94
37	1-Hydroxy-1,7-dimethyl-4-isopropyl-2,7-cyclodecadiene	0.83
38	Caryophyllene oxide	0.17
39	2,6,10-Dodecatrien-1-ol, 3,7,11-trimethyl-, (Z,E)-	0.20
40	2-Naphthalenemethanol, 1,2,3,4,4a,5,6,7-octahydro-.alpha.,.alpha.,4a,8-tetramethyl-, (2	0.05
41	2-Naphthalenemethanol, 1,2,3,4,4a,5,6,7-octahydro-.alpha.,.alpha.,4a,8-tetramethyl-, (2	0.42
42	1-Naphthalenol, 1,2,3,4,4a,7,8,8a-octahydro-1,6-dimethyl-4-(1-methylethyl)-, [1R-(1.al	0.74
43	alpha.-Cadinol	1.26
44	Cyclohexanemethanol, 4-ethenyl-.alpha.,.alpha.,4-trimethyl-3-(1-methylethenyl)-, [1R-(	0.04
45	2,6,10-Dodecatrien-1-ol, 3,7,11-trimethyl-, (Z,E)-	0.05
46	2-Naphthalenemethanol, 2,3,4,4a,5,6,7,8-octahydro-.alpha.,.alpha.,4a,8-tetramethyl-, [2	0.04
47	3-Octyne, 2,2,7-trimethyl-	0.05
48	Bicyclo[3.3.1]nonan-9-one, 2,4-dimethyl-3-nitro- (exo)-	0.16
49	Diazoacetic acid, 2-isopropyl-5-methylcyclohexyl ester	0.06
50	1,5,9-Decatriene, 2,3,5,8-tetramethyl-	0.40
51	Farnesol isomer a	0.76
52	3,3,7,11-Tetramethyltricyclo[5.4.0.0(4,11)]undecan-1-ol	0.38
53	Silicic acid, diethyl bis(trimethylsilyl) ester	0.07

Table 2: List of essential oil compounds of *C.winterianus*

Peak	Name	Area %
1	Androstan-17-one, 3-ethyl-3-hydroxy-, (5.alpha.)-	0.82
2	D-Limonene	2.38
3	1,6-Octadien-3-ol, 3,7-dimethyl-	0.70
4	Isopulegol	2.98
5	2-Octen-1-ol, 3,7-dimethyl-	5.38
6	Isopulegol	2.94
7	2-Octen-1-ol, 3,7-dimethyl-	5.38
8	2,6-Octadienal, 3,7-dimethyl-, (Z)-	0.32
9	2,6-Octadien-1-ol, 3,7-dimethyl-, (E)-	11.83
10	2,6-Octadienal, 3,7-dimethyl-, (E)-	0.40
11	Cyclohexanol, 2-(2-hydroxy-2-propyl)-5-methyl-	1.21
12	6-Octen-1-ol, 3,7-dimethyl-, acetate	3.31
13	Cyclohexanol, 2-(2-hydroxy-2-propyl)-5-methyl-	0.73
14	2,6-Octadien-1-ol, 3,7-dimethyl-, acetate, (E)-	5.94
15	Cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methylethenyl)-, [1S-(1.alpha.,2.beta.,4.beta	1.00
16	Naphthalene, 1,2,3,4,4a,5,6,8a-octahydro-7-methyl-4-methylene-1-(1-methylethyl)-, (1.a	0.22
17	1,6-Cyclodecadiene, 1-methyl-5-methylene-8-(1-methylethyl)-, [s-(E,E)]-	1.50
18	alpha.-Muurolene	0.25
19	Cyclohexane, 1-ethenyl-1-methyl-2,4-bis(1-methylethenyl)-, [1S-(1.alpha.,2.beta.,4.beta	0.33
20	Naphthalene, 1,2,3,4,4a,5,6,8a-octahydro-7-methyl-4-methylene-1-(1-methylethyl)-, (1.a	0.58
21	Naphthalene, 1,2,3,5,6,8a-hexahydro-4,7-dimethyl-1-(1-methylethyl)-, (1S-cis)-	1.87
22	Cyclohexanemethanol, 4-ethenyl-.alpha.,.alpha.,4-trimethyl-3-(1-methylethenyl)-, [1R-(	2.57
23	Cyclohexanemethanol, 4-ethenyl-.alpha.,.alpha.,4-trimethyl-3-(1-methylethenyl)-, [1R-(	2.57
24	tau.-Cadinol $$ 4-Isopropyl-1,6-dimethyl-1,2,3,4,4a,7,8,8a-octahydro-1-naphthalenol	0.68
25	2-Naphthalenemethanol, 1,2,3,4,4a,5,6,8a-octahydro-.alpha.,.alpha.,4a,8-tetramethyl-, [2	1.50
26	6-Octenal, 3,7-dimethyl-	1.66
27	(1-Bromo-1-methyl-ethyl)-2-methyl-cyclohexanol	0.26
28	(1-Bromo-1-methyl-ethyl)-2-methyl-cyclohexanol	0.37
29	Naphthalene, 2-decyldecahydro-	0.58
30	Bicyclo[3.3.1]nonan-9-one, 2,4-dimethyl-3-nitro- (exo)-	0.29
31	Diazoacetic acid, 2-isopropyl-5-methylcyclohexyl ester	0.39
32	Diazoacetic acid, 2-isopropyl-5-methylcyclohexyl ester	0.35
33	1,5,9-Decatriene, 2,3,5,8-tetramethyl-	1.47

34	1,5,9-Decatriene, 2,3,5,8-tetramethyl-	0.52
35	2,6,6,9,2',6',6',9'-Octamethyl-[8,8']bi[tricyclo[5.4.0.0(2,9)]undecyl]	0.18
36	Bicyclo[3.3.1]nonan-9-one, 2,4-dimethyl-3-nitro- (exo)-	0.15
37	Phosphonous dichloride, (1,7,7-trimethylbicyclo[2.2.1]hept-2-yl)-	0.20
38	Crotonic acid, menthyl ester	1.81
39	Farnesol isomer a	9.22
40	Squalene	12.44
41	Dodecanoic acid, 1,2,3-propanetriyl ester	0.58
42	11-Oxatricyclo[5.3.0.1(2,6)]undecan-4-one, 3-endo-5-endo-dimethyl-9-isopropylidene-	0.52
43	3.beta.-Myristoylolean-12-en-16.beta.-ol	0.65
44	Allopregnane-3.alpha.,20.alpha.-diol	0.46
45	Dodecanoic acid, 1,2,3-propanetriyl ester	0.25
46	Heneicosane, 3-methyl-	
47	beta.-Myristoylolean-12-en-16.beta.-ol	2.40

REFERENCES:

1) Soenarko, S. 1977. The genus Cymbopogon Sprengel (Gramineae). Reinwardtia 9(3): 225–375

2) Flora of China Vol. 22 Page 624 xiang mao shu Cymbopogon Sprengel, Pl. Min. Cogn. Pug. 2: 14. 1815.

3) "Atlas of Living Australia, Cymbopogon Spreng., Lemon Grass". Archived from the original on 2016-04-06. Retrieved 2015-03-21.

4) Bor, N. L. 1960. Grass. Burma, Ceylon, India & Pakistan i–767. Pergamon Press, Oxford

5) *Cymbopogon caesius* South African National Biodiversity Institute (SANBI), PlantZAfrica

6) Cymbopogon Species; Ethnopharmacology, Phytochemistry and the Pharmacological Importance by Opeyemi Avoseh 1,Opeoluwa Oyedeji 1,*,Pamela Rungqu 1,Benedicta Nkeh-Chungag 2 andAdebola Oyedeji 3, *Molecules* 2015, *20*(5), 7438-7453;

7) Filipoy A. Medicinal plants of the Pilaga of Central Chaco. J Ethnopharmacol. 1994;44:181–93. [PubMed] [Google Scholar].

8) Praditvarn L, Sambhandharaksa C. A study of the volatile oil from Siam lemongrass. J Pharm Assoc Siam. 1950;3:87–92. [Google Scholar]

9) Wasuwat SA. Asrct Bangkok, Report No. 1 on Res Project. 17. Thailand: A.S.R.C.T; 1967. List of Thai Medicinal plants; pp. 17–22. [Google Scholar]

10) Ngamwathana MO, Kanchanapee P. Investigation into Thai medicinal plants said to cure diabetes. J Med Assoc Thai. 1971;54:105–11. [PubMed] [Google Scholar]

11) Essential Oils from Steam Distillation., Biorenewables education laboratory, summer Academy, JB/CB 2011

12) Helen W Boucher 1, G Ralph Corey. Review: Epidemiology of methicillin-resistant Staphylococcus aureus., Clin Infect Dis. 2008 Jun 1;46 Suppl 5:S344-9

13) Kevin B Laupland 1, Terry Ross, Daniel B Gregson. Staphylococcus aureus bloodstream infections: risk factors, outcomes, and the influence of methicillin resistance in Calgary, Canada, 2000-2006. J Infect Dis. 2008 Aug 1;198(3):336-43

14) Vital Signs: Epidemiology and Recent Trends in Methicillin-Resistant and in Methicillin-Susceptible Staphylococcus aureus Bloodstream Infections — United States, Athena P. Kourtis,corresponding Kelly Hatfield,1 James Baggs,1 Yi Mu,1 Isaac See,1 Erin Epson,2 Joelle Nadle,3 Marion A. Kainer,4 Ghinwa Dumyati,5 Susan Petit,6 Susan M. Ray,7 Emerging Infections Program MRSA author group, David Ham,1 Catherine Capers,1 Heather Ewing,1 Nicole Coffin,1 L. Clifford McDonald,1 John Jernigan,1 and Denise Cardo1, MMWR Morb Mortal Wkly Rep. 2019 Mar 8; 68(9): 214–219. Published online 2019 Mar 8.

15) MRSA prevalence in european healthcare settings: a review, Madeleine Dulon, Frank Haamann, Claudia Peters, Anja Schablon & Albert Nienhaus BMC Infectious Diseases volume 11, Article number: 138 20 May 2011.

16) Gregory Steinkraus, Roger White, Lawrence Friedrich. Vancomycin MIC creep in non-vancomycin-intermediate Staphylococcus aureus (VISA), vancomycin-susceptible clinical methicillin-resistant S. aureus (MRSA) blood isolates from 2001–05, Journal of Antimicrobial Chemotherapy, Volume 60, Issue 4, October 2007, Pages 788–794,

17) SAssadullah, DKKakru1MAThoker, FABhat1NHussain, AShah, Emergence of low level Vancomycin resistance in MRSA. Indian Journal of Medical Microbiology, Volume 21, Issue 3, July–September 2003, Pages 196-198

18) Stapf G O Onawunmi, W A Yisak, E O Ogunlana, Antibacterial constituents in the essential oil of Cymbopogon citratus (DC.) J Ethnopharmacol, 1984 Dec;12(3):279-86

19) Hong Wu,1,2,3 Jilie Li ,1 Yuan Jia,1 Zhihong Xiao,2,3 Peiwang Li,2,3 Yixian Xie,1 Aihua Zhang,1,2,3 Rukuan Liu,2,3 Zewen Ren,1 Mengrui Zhao,1 Chaozhen Zeng,1 and Changzhu Li, Essential Oil Extracted from Cymbopogon citronella Leaves by Supercritical Carbon Dioxide: Antioxidant and Antimicrobial Activities 2,3, Volume 2019.

20) H. J. Zhang, Y. B. Cao, W. B. Xue, H. Ding, G. F. Liu, and J. Q. Wang, "Optimization of extraction process of citronella essential oil and its gas phase antibacterial properties," China Condiment, vol. 42, pp. 15–20, 2017.

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RAMAIAH
College of Arts, Science
& Commerce

SEED MONEY RESEARCH PROJECT

Reference Number:
PO/CIR/2020-21/017

A PROGRESS REPORT

ON

STRUCTURE BASED DESIGN AND FUNCTIONAL EVALUATION OF POTENTIAL INHIBITORS AGAINST HPV E6 PROTEIN

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STRUCTURE BASED DESIGN AND FUNCTIONAL EVALUATION OF POTENTIAL INHIBITORS AGAINST HPV E6 PROTEIN

Progress Report 1

Duration: December 2020- May 2021

Procurement of the Items: As per the requirement of the proposed project. Bioinformatics workstation was procured. It was supplied on 15.02.2021

1. INTRODUCTION

Human Papilloma virus (HPV) infection is one of the most common sexually transmitted diseases. Due to their oncogenic effect, some of the HPV strains have been identified as high-risk (HR) types, being the leading cause of cervical cancer and the etiologic agent of some anogenital tract and head and neck cancers (Allison D B *et al.*, 2015). Nowadays prophylactic vaccines, Cervarix (Monie A *et al.*, 2008) and Gardasil (Shi L *et al.*, 2007), have been approved and effectively used for the prevention of HPV infection. However, for people already infected, current therapies consist of the use of chemotherapeutic agents or the application of surgical methods to eliminate developed tumor (Hampson L *et al.*, 2015). These treatments are invasive, non-specific, and tend to be expensive, limiting their availability to millions of patients, particularly in developing countries.

Hence, one of the main alternatives to treat HPV-related diseases is the development of accessible drug-based therapies directed against the virus. E6 protein ensures cell immortalization by forming a complex with the cellular E3 ligase E6-associated protein (E6AP) and targeting p53 for degradation via the ubiquitin-proteasome pathway (MiHal S *et al.*, 2016) (Howie HL *et al.*, 2009). HPV-16 E6 is a small protein of 158 residues featuring two Zn^{2+} binding domains joined by a helix linker of 36 amino acids (Howie HL *et al.*, 2009). E6 can bind to multiple cellular proteins through a PDZ-domain-binding motif or by an inter-domain groove that acts as LxxLL binding pocket (Howie HL *et al.*, 2009).

In the case of E6-E6AP interaction, E6 pocket recognizes the LxxLL helical motif of the HECT domain of E6AP, which in turn recruits p53 to establish the p53 degradation complex (Martinez-Zapien D *et al.*,2016). Since HPV-induced tumors contain high levels of non-mutated p53 (Scheffner M *et al.*, 1991), the disruption of E6-E6AP interaction is a promising therapeutic strategy that focuses on the reactivation of p53 protein functions to ultimately induce cellular apoptosis of HPV-transformed cells. In addition, the E6 pocket consists of a

particular structure that cellular LxxLL-binding proteins do not have (Zanier K C. S *et al.*, 2013). This structural difference can be exploited to improve binding selectivity against a viral protein with respect to cellular components. Therefore, E6 pocket protein is one of the major targets for drug development against HPV infection and its oncogenic effects.

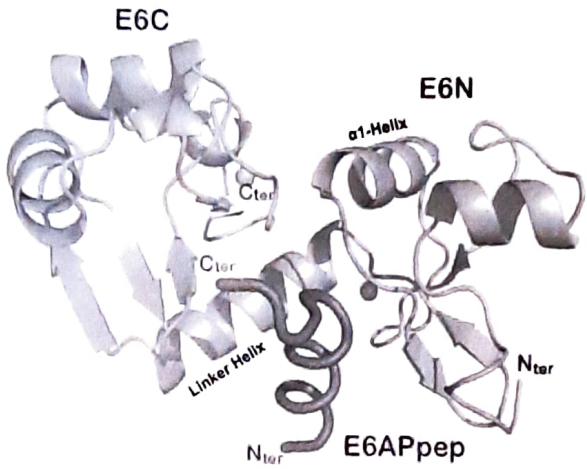

Figure 1.1 X-ray structure of HPV-16 E6 (gray) bound to E6APpep (green).

Structure-based drug design (SBDD) is the design and optimization of a chemical structure. It is one of the computer aided methods and is used with the goal of identifying a compound suitable for clinical testing - a drug candidate.

The knowledge of three-dimensional structure and biological functions of the drug by applying the principles of molecular recognition is the basis of structure-based drug designing.

Drug compounds are designed in such a way that they inhibit, restore or modify the structure and behaviour of target proteins. SBDD uses the already known 3D structure of proteins to aid in the development of new drug compounds. The 3D structure of protein targets is mostly obtained from x-ray crystallography or nuclear magnetic resonance (NMR) techniques. X-ray and NMR methods give a high resolution structure of proteins of few angstroms. At this level of resolution, the interactions between atoms in protein targets and atoms in potential drug compounds that bind to the proteins can be precisely examined. The ability to work at high resolution with both proteins and drug compounds makes SBDD one of the most useful methods in drug design (Debnath, 2012).

Drugs with high affinity to the target is generally expected so that they are more efficient with lesser side effects.

2. OBJECTIVE

The objective of this project is to design potential small molecule inhibitors against Human Papillomavirus E6 protein using a fragment-based approach.

3. MATERIALS AND METHODS

3.1 Hardware and Software

The study was carried out on bioinformatics Workstation with 32GB RAM, 1TB solid state drives running in windows 10 operating system with 4.8GHz processor and Intel core i7 10700 processor. Maestro Schrodinger 12.5 was used for target protein preparation, ligand preparation, fragmentation, breeding of small molecules and protein-ligand docking.

Maestro is the graphical user interface (GUI) for Schrödinger's computational programs: Glide, LigPrep, Phase, Prime, QikProp, etc. It contains tools required for building, displaying, and manipulating chemical structures; for organizing, loading, and storing these structures and associated data; and for setting up, submitting, monitoring, and visualizing the results of calculations on these structures. Jobs submitted from Maestro and from the command line to both local and remote hosts is managed by Maestro's Job Control facility. Maestro can be run locally and submit jobs to any host that you have access to. The Maestro interface uses the OpenGL graphics tools, and can take advantage of hardware graphics capabilities, including stereo viewing capabilities. Maestro runs on Linux, Mac, and Windows platforms (Maestro, Schrodinger, LLC, New York, NY 2015).

3.2. Retrieval of target protein structure - E6 of HPV16

E6 protein of Human papillomavirus (HPV) was chosen as drug target and the structure was retrieved from RCSB-PDB (http://www.rcsb.org/)(Berman H. M *et al.*,2000) with the PDB ID: 4GIZ (Zanier K *et al.*, 2013) in PDB format.

4GIZ is a Crystal structure of full-length human papillomavirus oncoprotein E6 in complex with LXXLL peptide of ubiquitin ligase E6AP at 2.55 Å resolution.

3.3. Target protein preparation

The target protein 4GIZ was preprocessed using Protein Preparation Wizard in Schrodinger suite by implying parameters like assigning bond orders, zero-order bonds to metal atoms, selenomethionine to methionine conversion, filling absent hydrogens, capping termini, side chains and loops and removing waters beyond 5Å distance surrounding the co-crystallized ligand (Protein Preparation Wizard; Epik, Schrödinger, LLC, New York, NY, 2021; Madhavi Sastry G *et al.*, 2013). In the Review and Modify section, out of the 6 chains (A, B, C, D, E, F) present in the crystal structure, only the C chain containing the E6 moiety was retained, and

the rest was deleted. The hydrogen bonds of the protein were optimized to renovate the overlying hydrogen atoms and minimized using OPLS-2005 force field with root mean square deviation (RMSD) value of 0.30 Å.

3.4. Receptor Grid Generation

The receptor grid was generated using Receptor Grid Generation module of Schrodinger (Friesner R. A. *et al.*, 2006; Glide, Schrödinger, LLC, New York, NY, 2021). In receptor grid generation module, the receptor is defined by selecting pick to identify ligand molecule. For scaling of Van der Waals radius, scaling factor and partial charge cutoff was set to 1.0 and 2.5 respectively. In site section, center for centroid of selected residues were chosen to specify the amino acid residue number (32 ,50, 53, 62, 64, 67, 70, 102, 128, 131) that constitutes the binding pocket of HPV 16 E6 protein (Zanier K *et al.*,2014).

3.5. Ligand Structure Retrieval

Chemical structures of 25 known inhibitors of HPV 16 E6 and the reference compound Luteolin was retrieved from ZINC database in SDF format (Irwin J. J *et al.*, 2005). They were converted to Maestro format for fragmentation.

3.6. Preparation of Ligands

The above said twenty-six molecules were prepared using LigPrep module of Schrodinger suite with the suitable parameters like 2D to 3D conversions, determination of protomers, tautomers, ionization states using Epik (at pH 7±2), most probable conformers of the molecules (LigPrep, Schrodinger, LLC, New York, NY, 2021; Madhavi Sastry G *et al.*,2013) and the energy minimization of inhibitors by using OPLS (Optimized Potentials for Liquid Simulations)-2005 force field were selected.

3.7. Fragment generation

Fragment generation process were performed with the known inhibitors of HPV 16 E6 using the Schrodinger PowerShell (Anika Jain *et al.*, 2019). Fragment based drug design involves fragmenting a drug or small molecule into smaller pieces and then combining these molecules to generate new molecules. A novel molecule is formed by the combination of different fragments that has binding affinity equal to sum of individual interactions of each fragment. In Maestro interface, fragment.py script was used to generate the fragments.

3.8. Breeding

The generated fragments were then filtered and used as input to the "BREED" module available in Schrödinger suite (Pierce A. C *et al.*, 2004). The BREED creates novel molecules by finding overlapping bonds from all the possible pairs of selected fragments and swapping the two sides

of the fragments. Maximum atom-atom distance of 1.0A°and maximum angle of 15.0 degrees were considered for bond overlap criteria of breed.

3.9. Molecular docking

All the fragments generated from fragment.py script and novel compounds generated from breed were docked into the generated grid of prepared HPV 16 E6 protein using Glide XP (extra precision) module of Schrodinger (Friesner R. A *et al.*, 2006; Glide, Schrödinger, LLC, New York, NY, 2021). Glide score is used to rank the various poses of novel inhibitors in complex with HPV 16 E6 protein, where the higher negative values reveal strong binding interaction of protein-ligand. Range was set from 1 to 1000. For Van der Waals radii scaling, the scaling factor of 0.08 and partial charge of 0.15 were chosen. Based on the docking scores, the molecules were selected for further studies.

4. RESULTS AND CONCLUSIONS

The structure of E6 protein of HPV 16 was retrieved from Protein Data Bank with PDB ID: 4GIZ. The target protein was prepared using Protein Preparation module of Schrodinger. The Receptor Grid Generation module was used to generate the receptor grid by specifying the amino acid numbers that form E6 protein binding pocket for E6AP. Twenty-six known compounds having inhibitory activity against HPV were identified from literature. Among them, Luteolin was considered as the reference compound. The sdf structures of all the 26 compounds were retrieved from ZINC database and prepared using LigPrep module. These compounds were converted into maestro format and then subjected to fragmentation with the help of fragment.py script using Schrodinger PowerShell. This resulted in 393 fragments which were XP docked into the E6 protein. 148 fragments which had docking score higher than the luteolin fragments were selected. All of these 148 fragments were linked together using BREED program of Schrodinger to design novel molecules with inhibitory activity against HPV E6 protein. The BREED produced 817 novel compounds which were then XP docked into E6 protein. Those compounds having lower docking scores than reference compound, luteolin were eliminated. This resulted in a final set of 10 novel compounds which were searched against ZINC and PubChem databases to verify that they were novel. All the 10 compounds were found to be novel.

5. FUTURE WORK

The binding free energy, pharmakinetic properties and toxicity of these ten novel compounds will be analysed to check their suitability as drug molecules.

In this proposed study, we aim to identify new candidate compounds that are capable of inhibiting the E6-E6AP interaction. The eventual outcome from this project will be a chemically suitable compound that can be entered into a drug development program.

REFERENCES

1. Allison D. B, Maleki Z. HPV-related head and neck squamous cell carcinoma: An update and review. *J Am Soc Cytopathol*. 2016;5(4):203–15.
2. Anderson A. C. The process of structure-based drug design. *Chem Biol*. 2003;10(9):787–97.
3. *Approach For Drug Discovery*. Retrieved from Netaji Subhas Chandra Bose Institute of Pharmacy: https://www.nscbip.org/uncategorized/structure-based-drug-design-sbdd-positive-approach-for-drug-discovery/#:~
4. Badal S. Plant Metabolites and More Treating Various Ailments: Natural Products Treating Diseases. *Pharmacognosy*; 2017.
5. Baleja J. D, Cherry J. J, Liu Z, Gao H, Nicklaus M. C, Voigt J. H, et al. Identification of inhibitors to papillomavirus type 16 E6 protein based on three-dimensional structures of interacting proteins. *Antiviral Res*. 2006;72(1):49–59.
6. Berman H. M. The Protein Data Bank. *Nucleic Acids Res*. 2000;28(1):235–42.
7. Beutner K. R, Ferenczy A. Therapeutic approaches to genital warts. *Am J Med*. 1997;102(5):28–37
8. Bruni L, B.-R. L. (2017). Human Papillomavirus and Related Diseases Report. *HPV*
9. Cherry J. J, Rietz A, Malinkevich A, Liu Y, Xie M, Bartolowits M, et al. Structure based identification and characterization of flavonoids that disrupt human Papillomavirus-16 E6 function. *PLoS One*. 2013;8(12): e84506.
10. Debnath, U. (2012, September 21). Structure-Based Drug Design (SBDD): *Positive Approach For Drug Discovery*. Retrieved from Netaji Subhas Chandra Bose Institute of Pharmacy: https://www.nscbip.org/uncategorized/structure-based-drug-design-sbdd-positive-approach-for-drug-discovery/#:~
11. Friesner R. A, Murphy R. B, Repasky M. P, Frye L. L, Greenwood J. R, Halgren T. A, et al. Extra precision glide: Docking and scoring incorporating a model of hydrophobic enclosure for Protein−Ligand complexes. *J Med Chem*. 2006;49(21):6177–96.
12. Glide, Schrödinger, LLC, New York, NY, 2021.
13. Ham S, Kim K. I. H, Kwon T. H. O, Bak Y, Lee D. H, Song Y. S, et al. Luteolin induces intrinsic apoptosis via inhibition of E6/E7 oncogenes and activation of extrinsic and

intrinsic signaling pathways in HPV-18-associated cells. *Oncol Rep*. 2014;31(6):2683–91.

14. Harvey A. L. Plant Natural Products in Anti-Diabetic Drug Discovery. *Current Organic Chemistry*. 2010;14(16).
15. Howie HL, Katzenellenbogen R A, Galloway D. A. Papillomavirus E6 proteins. *Virology*. 2009;384(2):324–34.
16. Irwin J. J, Shoichet B. K. ZINC – A free database of commercially available compounds for virtual screening. *J Chem Inf Model*. 2005;45(1):177–82.
17. Jain A, James N, Shanthi V, Ramanathan K. Design of ALK inhibitors for non-small cell lung cancer – A Fragment based approach. *Ind J Pharm Educ*. 2019;54(1):114–24
18. Klebe G. Recent developments in structure-based drug design. *J Mol Med*. 2000;78(5):269–81.
19. LigPrep, Schrödinger, LLC, New York, NY, 2021.
20. Madhavi Sastry G, Adzhigirey M, Day T, Annabhimoju R, Sherman W. Protein and ligand preparation: parameters, protocols, and influence on virtual screening enrichments. *J Comput Aided Mol Des*. 2013;27(3):221–34.
21. Maestro, Schrödinger, LLC, New York, NY, 2021.
22. Martinez-Zapien D, Ruiz F. X, Poirson J, Mitschler A, Ramirez J, Forster A, et al. Structure of the E6/E6AP/p53 complex required for HPV-mediated degradation of p53. *Nature*. 2016;529(7587):541–5.
23. McLaughlin-Drubin M. E, Münger K. The human papillomavirus E7 oncoprotein. *Virology*. 2009;384(2):335–44.
24. Mittal S, Banks L. Molecular mechanisms underlying human papillomavirus E6 and E7 oncoprotein-induced cell transformation. *Mutat Res Rev Mutat Res*. 2017; 772:23–35.
25. Monie A, Hung C. F, Roden R, Wu T. C. Cervarix: a vaccine for the prevention of HPV 16, 18-associated cervical cancer. *Biologics*. 2008;4.
26. Munagala R, Kausar H, Munjal C, Gupta RC. Withaferin A induces p53-dependent apoptosis by repression of HPV oncogenes and upregulation of tumor suppressor proteins in human cervical cancer cells. *Carcinogenesis*. 2011;32(11):1697–705.
27. Palasap A, Limpaiboon T, Boonsiri P, Thapphasaraphong S, Daduang S, Suwannalert P, et al. Cytotoxic effects of phytophenolics from Caesalpinia mimosoides lamk on cervical carcinoma cell lines through an apoptotic pathway. *Asian Pac J Cancer Prev*. 2014;15(1):449–54.

28. Pierce A. C, Rao G, Bemis G. W. BREED: Generating novel inhibitors through hybridization of known ligands. Application to CDK2, P38, and HIV protease. *J Med Chem*. 2004;47(11):2768–75.
29. Prime, Schrödinger, LLC, New York, NY, 2021.
30. Protein Preparation Wizard; Epik, Schrödinger, LLC, New York, NY, 2021.
31. Scheffner M, Munger K, Byrne J. C, Howley PM. The state of the p53 and retinoblastoma genes in human cervical carcinoma cell lines. *Proc Natl Acad Sci U S A*. 1991;88(13):5523–7.
32. In silico approach to identify high affinity small molecule targeting m-TOR inhibitors for the clinical treatment of breast cancer. *Asian Pac J Cancer Prev*. 2019;20(4):1229–41.
33. Zanier K, Charbonnier S, Sidi A.O.M.O, McEwen A. G, Ferrario MG, Poussin-Courmontagne P, et al. Structural basis for hijacking of cellular LxxLL motifs by Papillomavirus E6 oncoproteins. *Science*. 2013;339(6120):694–8.
34. Zanier K, Stutz C, Kintscher S, Reinz E, Sehr P, Bulkescher J, et al. The E6AP binding pocket of the HPV16 E6 oncoprotein provides a docking site for a small inhibitory peptide unrelated to E6AP, indicating druggability of E6. *PLoS One*. 2014;9(11): e112514.
35. Zishan M, S S. NATURAL PRODUCTS USED AS ANTI-CANCER AGENTS. *Journal of drug discovery and therapeutics*. 2017;7(3).

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DEPARTMENT OF MICROBIOLOGY

Seed Money Research Project

Reference No: PO/CIR/2020-21/018

PROGRESS REPORT

ON

Control and detoxification of Mycotoxins in food and feed -A Biological approach

Principal Investigator

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Dept of Microbiology

Ramaiah College of Arts, Science and Commerce

Title of the Project: Control and detoxification of Mycotoxins in food and feed - A Biological approach.

Progress Report- I

Period December 2020 to May 2021

Procurement of Project requirements: The project work was initiated with the formal procedure for procuring the chemicals, reagents, glassware, plastic ware and consumables required for the project. The items were received from the vendor in the months of March and April 2021.

1. INTRODUCTION:

Mycotoxins are secondary metabolites produced by filamentous fungi that have deleterious effects on humans and animals after consumption. From the context of food safety, these mycotoxigenic fungi are the most important pathogens of global significance (Moretti *et al.*, 2017). This group of fungi can reduce the quality and quantity of marketable produce by damaging the commodities like corn, rice and peanuts. Mycotoxigenic fungi and mycotoxins are a major concern worldwide due to the environmental and storage conditions that favour the growth and development of mycotoxigenic fungi (Anukul *et al.*, 2013). Mycotoxigenic fungi play a major role in declining the quality and quantity of agricultural commodities. Mycotoxin are produced by a wide variety of filamentous fungi including species from the genera *Aspergillus, Fusarium, Penicillium, Alternaria, and Claviceps* (Marin *et al.*, 2018). Mycotoxins appear in the food chain as the result of mould infection of crops before and after harvest. They occur in cereals, cereal products and foods, animal products and soil. Mycotoxins can be transferred from feed to food of animal origin (Temesgen *et al.*, 2018). They also carry over through animal derived products such as meat milk and eggs and transfer them into human food chains. All crops and cereal which are stored improperly under favorable temperature and prompting humidity for a longtime facilitate mycotoxin contamination (Ahmad and Jae 2017).

Aflatoxins comprise of a group of 20 fungal metabolites out of which only B1, B2, G1, G2, M1, M2 are usually found in foods. Aflatoxins B1 and B2 are produced by *Aspergillus flavus* and *Aspergillus parasiticus* whereas aflatoxins G1 and G2 are produced by *Aspergillus parasiticus* (Wacoo *et al.,* 2014). Aflatoxins greatly impact the food and feed industry because they are highly toxic and carcinogenic to a variety of animal species (William *et al.*, 2004).

Although prevention of contamination of feed samples by mycotoxigenic fungi is the most economical method of reducing the potential health hazards, prevention is not always possible under certain storage practices, material handling etc. In the present situation one of the best possible options is to detoxify the already contaminated samples using biological approaches. The existing knowledge about certain plants which have medicinal properties, antibacterial, antifungal properties can be explored for this purpose. The biological approach has proven to be the most effective and economical to detoxify the aflatoxin in feed samples.

2. OBJECTIVES:

From the above background it is clear that numerous harmful effects of Aflatoxins are caused when it is consumed by humans or animals. Cattle or poultry feeds contaminated with these toxins when ingested by animals or birds can lead to various health disorders and severe economic losses. Taking into consideration all the above, the project work involved the following objectives.

- Collection of feed samples, isolation and identification of mycoflora.
- Extraction and detection of Aflatoxin production by chromatography.

3. MATERIALS AND METHODS:

3.1. Sample collection

The samples were collected from poultry and animal farms from different parts of India; Jharkhand, Karnataka and Tamil Nadu. The samples were collected with utmost care, labelled respectively and were put in zipper lock polythene bags. They were taken to the laboratory for further analysis.

3.2. Isolation of Fungi

The feed samples were serially diluted in sterile water and then subjected for isolation of mycoflora by standard pour plate method using Martin Rose Bengal Agar (MRBA) and then the plates were incubated at 28°C for 5-7 days (Shah *et al.*, 2018).

3.3. Identification of Mycoflora

The isolated colonies on the MRBA plates were subjected to identification morphologically and microscopically by staining with Lactophenol cotton blue. The fungi were identified

according to the Manual of Barnet *et.al* (2004) and standard manuals and the results were recorded. The fungal colonies were subcultured on PDA to obtain pure cultures and stored at 4 ℃ until further use.

3.4. Sample Preparation

Sample preparation for the extraction of mycotoxins was done by growing the pure culture of *Aspergillus flavus* in yeast extract sucrose (YES) broth and incubating at room temperature for 7 days.

3.5. Extraction of Aflatoxins

One week old broth cultures were filtered using Whatman filter paper. The culture filtrates were mixed with equal volume of chloroform. The mixture was thoroughly mixed, taken into a separating funnel and allowed for the separation of the two layers. After some time the organic solvent layer enriched with aflatoxin, was collected into a beaker. The solvent was left for evaporation. Later the detection of aflatoxins was done by TLC.

3.6. Detection of Aflatoxins by Chromatography

Aflatoxin extract obtained in the extraction method was mixed with 1ml of chloroform to dissolve the toxin. The sample was spotted using capillary tube onto the TLC sheet. The TLC sheets were placed in a beaker with mobile phase (chloroform: water in 9:1 ratio) and allowed to run. When the solvent front had reached 3/4th of the sheet, the sheet was removed from the mobile phase and allowed for drying. After the TLC sheets completely dried, the presence of aflatoxins was detected using a UV transilluminator.

4. RESULTS AND DISCUSSION

4.1. Collection of feed samples, Isolation and Identification of Mycoflora:

Feed samples were collected from Poultry and Animal farms located in different parts of India- Jharkhand, Karnataka and Tamilnadu. The various feed sample collected were subjected to fungal isolation using MRBA medium. Morphological identification of isolated fungi was carried out using microscopy as well as based on cultural characteristics. Among the isolated feed sample mycoflora, the most predominant genus was *Aspergillus* (40.2%) which included *Aspergillus flavus* (30.4%) and *Aspergillus niger* (9.8%). The next genus that

according to the Manual of Barnet *et.al* (2004) and standard manuals and the results were recorded. The fungal colonies were subcultured on PDA to obtain pure cultures and stored at 4 °C until further use.

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was dominant was *Penicillium sp* with 20.5%, followed by *Fusarium* with 10.3% occurance. *Cladosporium*, *Alternaria* and *Candida* together occurred at 14.6%, sterile mycelium was seen at 18.5%.

Mycotoxin producing fungi are important pathogens of global significance with respect to food security and safety. These fungi and their toxins can reduce the quantity and quality of the product (corn, rice and cereals). If the feed samples contaminated with mycotoxins are ingested by animals or poultry, it can cause serious health disorders (Balendres *et al.*, 2019). The presence of microscopic fungi affects the quality of feeds, their organoleptic properties and nutritional quality (Shareef 2010). The contamination of animal feed with mycotoxins may induce sanitary disturbances and mortality among animals and cause secondary contamination of human consumers via eggs, meat/milk (Nyamonso and Okioma, 2005). When mycotoxins contaminated diet is consumed for a longer time it may induce acute and long term chronic effects (Binder 2007). Mycotoxins exhibit toxic effects on human and animals which are characterized by carcinogenic, mutagenic, teratogeinic and estrogenic properties (Shareef 2010).

4.2. Extraction and detection of Aflatoxin production by chromatography:

Aspergillus flavus obtained from the four samples were subjected for extraction of Aflatoxins. The aflatoxin produced by *Aspergillus flavus* from the samples were identified by thin layer chromatography. From the study performed, it was observed that two types of Aflatoxins (B1 and G1) were produced by toxigenic strains of *Aspergillus flavus* obtained from four samples. *Aspergillus flavus* culture obtained from poultry feed, showed blue bands indicating the presence of Aflatoxin B1. The sample MSLG obtained from poultry farm showed the presence of Aflatoxin G. The RF values of Aflatoxin B1 and Aflatoxin G1 obtained from *A. flavus* isolated from poultry feed sample was found to be 0.703and 0.734 respectively.

The growth of *Aspergillus flavus* or *Aspergillus parasiticus* in poultry feed stuffs is usually accompanied by the production of many toxic secondary metabolites such as Aflatoxins B1 (AFB1), B2 (AFB2), G1 (AFG1) and G2 (AFG2) (Arafa *et al.*, 1981). The unsafe effect of AFB1 in poultry are associated with low productivity and makes them highly susceptible to diseases which can have negative impact on producers income as well as by affecting humans health (Oliveira *et al.*, 2003; Khlangwiset *et al.*, 2011). AFB1 is considered as being hepatotoxic, carcinogenic, and mutagenic and it is the third most important cause of liver

cancer, especially in Sub-Saharan Africa and developing countries in Asia (De Ruyck*et al.*, 2015; Wu *et al.*, 2014).

5. CONCLUSION

Determination of the different mycotoxigenic fungi and analysis of mycotoxins produced in the food and feed samples is a very important practice to ensure food quality and safety. The current study was carried out to isolate and identify the mycotoxigenic fungi associated with different feed samples and the extraction and detection of the aflatoxins produced by these fungi using chromatographic technique.

6. FUTURE WORK PLAN

Botanicals such as essential oils, spices, herbs and plant extracts are regarded as environment friendly and safer alternative sources of biocontrol agents of mycotoxins in food and feed. The future work plan will involve the *invitro* evaluation of growth inhibitory effects of plant extracts against aflatoxigenic fungi and studies will be conducted to detect their aflatoxin degrading ability.

7. REFERENCES

Ahmad A and Jae-Hyuk Y (2017). Occurrence, Toxicity, and Analysis of Major Mycotoxins in Food. International Journal of Environmental Research and Public Health, 14:632.

Anukul N., Vangnai K., Mahakarnchanakul W (2013). Significance of regulation limits in mycotoxin contamination in Asia and risk management programs at the national level. Journal of Food and Drug Analysis, 21:227–241.

Arafa, A.S., Bloomer, R.J., Wilson, H.R., Simpson, C.F and Harms, R.H (1981). Susceptibility of various poultry species to dietary aflatoxin. British Poultry Science, 22, 431–436.

Balendres, Karlovsky, and Cumagun (2019). Mycotoxigenic Fungi and Mycotoxins in Agricultural Crop Commodities in the Philippines: A Review. Foods, 8(7), 249.

Binder, E. M., Tan, L. M., Chin, L. J., Handl, J and J. Richard (2007). Worldwide occurrence of mycotoxins in commodities, feeds and feed ingredients. Animal Feed Science and Technology, 137 (3) 265–282.

De Ruyck, K., De Boevre, M., Huybrechts, I and De Saeger, S (2015). Dietary mycotoxins, co-exposure, and carcinogenesis in humans: Short review. Mutation Research- Reviews in Mutation Research. 766, 32–41.

Khlangwiset, P., Shephard, G.S and Wu, F (2011). Aflatoxins and growth impairment: A review. Critical Reviews in Toxicology, 41, 740–755.

Marín, S., Cano-Sancho, G., Sanchis, V and Ramos, A. J (2018). The role of mycotoxins in the human exposome: Application of mycotoxin biomarkers in exposome-health studies. Food and Chemical Toxicology, 121, 504-518.

Moretti A.T., Logrieco A.F and Susca A (2017). Mycotoxin: An underhand food problem. In: Moretti A., Susca A., editors. Mycotoxigenic Fungi Methods and Protocols. Humana Press; New York, NY, USA. pp. 3-12

Nyamongo J and M. Okioma (2005). The aflatoxin outbreaks in Kenya in 2004 and 2005: a case study, in Proceedings of the Conference on Reducing Impact of Mycotoxins in Tropical Agriculture with Emphasis on Health and Trade in Africa, p. 3.

Oliveira, C.F., Rosmaninho, J.F., Castro, A.L., Butkeraitis, P., Reis, T.A and Corrêa, B (2003) Aflatoxin residues in eggs of laying Japanese quail after long-term administration of rations containing low levels of aflatoxin B1 . Food Additives and Contaminants 20, 648–653.

Shah, M. M and Sharif, U. (Eds.) (2018). Insect Science: Diversity, Conservation and Nutrition. BoD–Books on Demand.

Shareef, A. M (2010) Molds and mycotoxins in poultry feeds from farms of potential mycotoxicosis, Iraqi Journal of Veterinary Sciences, 24, no. 1, pp. 17–25.

Temesgen Assefa and Teshome Geremew (2018) Major Mycotoxins occurrence, prevention and control approaches toxicology, exposure, potential health consequence vol 12(1), 1-11.

Wacoo, A. P., Wendiro, D., Vuzi, P. C and Hawumba, J. F. (2014). Methods for Detection of Aflatoxins in Agricultural Food Crops. Journal of Applied Chemistry, 1–15.

Williams J, Phillips T, Jolly P, Stiles J, Jolly C and Aggarwal D (2004) Human aflatoxicosis in developing countries- A review of toxicology, exposure, potential health consequences, and interventions. American Journal of Clinical nutrition 80, 1106-1122.

Wu, F., Groopman, J.D. and Pestka, J.J (2014) Public health impacts of foodborne mycotoxins. Annual Reviews in Food Science and Technology, 5, 351–372.

Principal Investigator 17/9/21

HOD 17/9/2021.

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M S Ramaiah College of Arts, Science and Commerce
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Recognized by UGC under 2f & 12B of UGC act 1956
(National Institutional Ranking Framework, Ministry of Education, Govt of India)
Ranked 62nd in NIRF India Ranking by MHRD, New Delhi
DBT Star College Scheme

To,
The Principal,
RCASC,
Bengaluru.

From,
Bharath K. Devendra,
Department of Chemistry,
RCASC,
Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal

Dear Madam,

I, Bharath K. Devendra, Assistant Professor, belonging to Department Chemistry/Biochemistry and Co PI, Dr. R Hari Krishna, Assistant Professor, MSRIT have submitted proposal entitled "Advanced Strategies for Hydrogen Generation and Dye degradation Applications using Noble Metal Catalysts" for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.

As per the statement in our proposal, this project will be completed in the next 2 years (or 3 years) from the start day of the project 24th May 2022.

We are happy to abide with the Terms & Conditions as mentioned by the institution.
Sincerely yours,

Bharath K. Devendra
07/06/2022

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ಎಮ್ ಎಸ್ ರಾಮಯ್ಯ ಕಲಾ, ವಿಜ್ಞಾನ ಮತ್ತು ವಾಣಿಜ್ಯ ಕಾಲೇಜು
M S Ramaiah College of Arts, Science and Commerce
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nirf (National Institutional Ranking Framework, Ministry of Education, Govt of India)
Ranked 62nd in NIRF India Ranking by MHRD, New Delhi
DBT Star College Scheme

OFFICE ORDER

To,

Mr. Bharath K Devendra
Asst Professor
Dept of Chemistry/ BC
MSRCASC

Madam,

Sub: Sanction order of the seed money project

We are glad to inform you that the Seed Funding Proposal submitted by you has been approved after due evaluation and the seed money of ₹3.70 lakhs for the project duration of 2 years has been sanctioned by the Management for the Research Project.

You may start your project work immediately and submit the progress report of the project every six months to the undersigned.

Dr. A. Nagarathna
Principal,
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore - 560 054

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MSRIT Post
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To,
The Principal,
RCASC,
Bengaluru.

From,
Dr. Shashidhar Bharadwaj S.,
Department of Chemistry,
RCASC,
Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal

Dear Madam,

I PI: Dr. Shashidhar Bharadwaj S & Asst. Professor, belonging to Department Chemistry and Biochemistry and Co-PI: Dr. Samrat & Asst. Professor have submitted proposal entitled' Design, Synthesis and Evaluation of Quinoline Hybrids as Novel Inhibitors against the P. Falciparum Dihydrofolate Reductase (Pfdhfr) of Possible Promising Antimalarial: Investigation of Antimalarial Activities' for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.
As per the statement in our proposal, this project will be completed in the next 2 years (or 3 years) from the start day of the project (10/06/2022).

We are happy to abide with the Terms & Conditions as mentioned by the institution.

Sincerely yours,

Dr. Shashidhar Bharadwaj S.,

26/05/2022

M S R Nagar, Nagasandra Post
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Bangalore 560 054
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+91 80 2360 6215
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DBT Star College Scheme

OFFICE ORDER

To,

Dr. Shashidhar Bharadwaj S
Asst Professor
Dept of Chemistry/ BC
MSRCASC

Sir,

Sub: Sanction order of the seed money project

We are glad to inform you that the Seed Funding Proposal submitted by you has been approved after due evaluation and the seed money of ₹4.95 lakhs for the project duration of 3 years has been sanctioned by the Management for the Research Project.

You may start your project work immediately and submit the progress report of the project every six months to the undersigned.

Dr. A. Nagarathna
Principal,
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore - 560 054

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College of Arts, Science & Commerce

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DBT Star College Scheme

To,
The Principal,
RCASC,
Bengaluru.

From,
Dr. Hareesh Kumar P
Department of Chem/Biochemistry
MSRCASC,
Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal

Dear Madam,

I, Dr. Hareesh Kumar P, Assistant Professor, belonging to Department Chemistry/ Bio -Chemistry and Mr. Prasanna Kumar S G, Associate Professor, As have submitted proposal entitled: **A Novel Process for the preparation of Molnupiravir - Anti – Viral repurposed to Anti – Covid – 19 agent'** for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.

As per the statement in our proposal, this project will be completed in the next 3 years from July 2022

We are happy to abide with the Terms & Conditions as mentioned by the institution.

Sincerely yours,

Dr. Hareesh Kumar P

Mr. Prasanna Kumar S.G. (for RCASC only)

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College of Arts, Science & Commerce

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DBT Star College Scheme

OFFICE ORDER

To,

Dr. Hareesh Kumar P
Asst Professor
Dept of Chemistry/ BC
MSRCASC

Madam,

Sub: Sanction order of the seed money project

We are glad to inform you that the Seed Funding Proposal submitted by you has been approved after due evaluation and the seed money of ₹4.95 lakhs for the project duration of 3 years has been sanctioned by the Management for the Research Project.

You may start your project work immediately and submit the progress report of the project every six months to the undersigned.

Received the order

Dr. A. Nagarathna
Principal,
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Banaalore - 560 054

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Ranked 62 in NIRF India Ranking by MHRD, New Delhi
DBT Star College Scheme

To,
The Principal
MSRCASC
Bengaluru.

Date: 26/05/2022

From,
Dr. Vibha Vinayakumar Bhat
Department of Chemistry & Biochemistry
MSRCASC
Bengaluru.

Sub: Submission of Declaration Letter for the approved Seed Money Proposal

Dear Madam,

I, PI, Dr. Vibha Vinayakumar Bhat, Assistant Professor, Department of Chemistry & Biochemistry, MSRCASC and Co-PI Mrs. Ramya Kumari B. S., Assistant Professor, Department of Chemistry & Biochemistry, MSRCASC, have submitted the proposal entitled "**Synthesis of fumaramide derivatives of Lanthanum (III) complexes and their screening for AChE and BuChE inhibition activities**" for seed money. We sincerely thank you and management for considering our proposal and granting the seed money.
As per the statement in our proposal, this project will be completed in the next 3 years from the start day of the project 24/05/2022.

We are happy to abide by the Terms & Conditions as mentioned by the institution.

Sincerely yours,

PI 26/05/22
(Dr. Vibha Vinayakumar Bhat)

Co-PI 26/05/22
(Ramya Kumari B S)

RAMAIAH
College of Arts, Science & Commerce

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DBT Star College Scheme

OFFICE ORDER

To,

Dr. Vibha Vinayakumar Bhat
Asst Professor
Dept of Chemistry/ BC
MSRCASC

Madam,

Sub: Sanction order of the seed money project

We are glad to inform you that the Seed Funding Proposal submitted by you has been approved after due evaluation and the seed money of ₹3.25 lakhs for the project duration of 3 years has been sanctioned by the Management for the Research Project.

You may start your project work immediately and submit the progress report of the project every six months to the undersigned.

Dr. A. Nagarathna
Principal,
M.S. Ramaiah College of Arts, Science & Commerce
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Bangalore - 560 054

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OFFICE ORDER

To,

Dr. Vibha Vinayakumar Bhat
Asst Professor
Dept of Chemistry/ BC
MSRCASC

Madam,

Sub: Sanction order of the seed money project

We are glad to inform you that the Seed Funding Proposal submitted by you has been approved after due evaluation and the seed money of ₹3.25 lakhs for the project duration of 3 years has been sanctioned by the Management for the Research Project.

You may start your project work immediately and submit the progress report of the project every six months to the undersigned.

Order Received
Thanking You
04/05/2022

Dr. A. Nagarathna
Principal,
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore - 560 054

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GOKULA EDUCATION FOUNDATION

MSR NAGAR, BANGALORE-560054.

Date: 26/04/2022

From: The Chief of Finance GEF (Engg. & GS).	To: The Chief Executive GEF (Engg. & GS).

Sub: Seed Money Grant 2021 for M S Ramaiah College of Arts, Science and Commerce.

******

We have introduced a scheme of providing Seed Funding for Research Projects as this will help in developing research culture and publications. Accordingly, applications were invited from the faculties and shortlisted projects were presented before the committee consisting Dr. Chandraprabha, Professor & HOD, Department of Biotechnology, RIT and Dr. B M Nagabhushana, Professor & HOD, Department of Chemistry, RIT. The Chief Executive, Chief of Finance of GEF(E) and Principal of RCASC were also present in the meeting.

The following projects have been considered for funding.

Sl. No	Principal Co-ordinator/ Co-Investigator	Department	Project Name	Amount Requested (In Lakhs)	Amount Sanctioned (In Lakhs)	Project Duration
1	Dr. M. Vidya, MSRCASC / Dr. Krishnamurthy TP, MSRIT, Dr. Manikandan A, MSRCASC	Chemistry / BC	In Silico and In Vitro Screening of natural products for Triple Negative Breast Cancer.	Resigned 4.65	3.40	2 years
2	Dr. Vibha Vinayakumar Bhat, MSRCASC / Mrs. Ramya Kumari B S, MSRCASC	Chemistry / BC	Synthesis of fumaramide derivatives of Lanthanum (III) complexes and their screening for AChE and BuChE inhibition activities.	3.90	3.25	3 years
3	Dr. Shashidhar Bharadwaj, MSRCASC / Dr. Samrat K, MSRIT	Chemistry / BC	Design, Synthesis & Evaluation of Quinoline hybrids as Novel Inhibitors against the P Falciparum Dihydrofolate Reductose (Pfdhfd) of possible promising antimalorial: Investigation of Antimalorial activities.	5.00	4.00	2 years 6 months

2...

Sl. No	Principal Co-ordinator/ Co-Investigator	Department	Project Name	Amount Requested (In Lakhs)	Amount Sanctioned (In Lakhs)	Project Duration
4	Mr. Bharath K Devendra, MSRCASC / Dr. R Hari Krishna, MSRIT	Chemistry / BC	Advanced Strategies for Hydrogen Generation and Dye degradation Applications using Noble Metal Catalysts.	4.00	3.70	2 years
5	Dr. Hareesh Kumar P, MSRCASC / Mr. S G Prasanna Kumar, MSRCASC	Chemistry / BC	A Novel Process and their analogues preparation of Molnupiravir: are purposed drug for Anti- Covid-19 agent.	5.20	4.95	3 years
	Total			**22.75**	**19.30**	

Out of the proposed total funding of Rs.19.30 lakhs an amount of Rs.9.95 lakhs will be used for procuring equipments and the same will be used in the college for teaching propose in addition to research.

For kind approval and orders.

Chief of Finance

Chief Executive

The Hon'ble Director, MSRCASC.

The Hon'ble Director MSRCASC.

RAMAIAH
College of Arts, Science & Commerce

Inter Office Memo

From:	Through:	To:
The Principal RCASC	The Chief of Finance GEF	The Chief Executive GEF

Date: 22.04.2022

Respected Sir,

Sub: Seed Money grant 2021.

With respect to your note, the abstract of the proposal has been enclosed herewith and the following is the summary

Sl No	Principal Coordinator	Department	Project Name	Amount Requested (In Lacs)	Amount sanction (In Lacs)
1.	Dr. M. Vidya	Chemistry/ BC	In Silico and In Vitro Screening of natural products for Triple Negative Breast Cancer	4.65	3.4
2.	Dr. Vibha Vinayakumar Bhat	Chemistry/ BC	Synthesis of fumaramide derivaties of Lanthanum (III) complexes and their screening for AChE and BuChE inhibition activities	3.90	3..25
3.	Dr. Shashidhar Bharadwaj	Chemistry/ BC	Design, Synthesis & Evaluation of Quindine hydrids as Novel Inhibitors against the P Falciparum Dihydrofolate Reductose (pfdhfd) of possible promising antimalorial: Investigation of Antimalorial Activities.	5.00	4.00
4.	Mr. Bharath K Devendra	Chemistry/ BC	Advanced Strategies for Hydrogen Generation and Photo catalyst Applications using Noble Metal Catalysts.	4.00	3.70
5.	Dr. Hareesh Kumar P	Chemistry/ BC	A Novel Process for the preparation Molnupiravir- Anti- Viral repurposed to Anti- Covid-19	5.2	4.95
	Total			**22.75/-**	**19.30/-**

I request you to kindly approve and release the seed money sanction order.
Thanking you

Dr. A Nagarathna
Principal

RAMAIAH
College of Arts, Science & Commerce

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nirf

Perused.

RESEARCH AND DEVELOPMENT FUND

EVALUATION CRITERIA

Name of the principal investigator	Dr. M. VIDYA
Department	Chemistry & Biochemistry
Affiliation	MS Ramaiah college of Arts, Science & Commerce.
Name of the Co-Principal Investigator	Dr. Krishnamurthy TP Dr. Manikandan
Department	Dept. of Biotechnology Dept of Microbiology
Affiliation	MSRIT MSRCASC

Title of the Proposal

In silico and In vitro screening of Natural products against Triple Negative breast cancer

Excellent 5; Very Good 4; Good 3; Fair; Poor 1

Item	*Evaluation Criteria*	***5***	***4***	***3***	***2***	***1***	***Actual Marks***
1.	*Introduction and Rationale (Background, Problem statement and aims/ objectives)*						5
2.	*Literature Review (Relevance, recent developments, and organization of issues, etc)*						3
3.	*Research Methodology (appropriateness of methods and experimental design, etc)*						4
4.	*Feasibility of study and preliminary results (suitability to scope, aims, resources, outcomes and practicality)*						3
5.	*Expertise of PI/ Co-PI (expertise, publications and networking)*						4

6.	Impact on Socio-Economic issues						4
7.	Budget						4
8.	Overall performance (presentation skills, pro activeness and confidence in Q & A session etc)						4
					Total		31

Overall Decision	**Satisfactory**	**Satisfactory*** ✓ **With minor amendments/ comments to improve**	**Unsatisfactory (less than 20 marks)**

Signature of Panel Member:

Name of the Panel Member : Dr Chandrapratha Date: 23/3/22

Title of the project:

Comments:

1) Novelty of the work is not highlighted.
2) Detailed literature Review specific to similar studies reported earlier is to be included.

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RESEARCH AND DEVELOPMENT FUND

EVALUATION CRITERIA

Name of the principal investigator	Dr. Vidya.
Department	Biochemistry
Affiliation	
Name of the Co-Principal Investigator	
Department	
Affiliation	
Title of the Proposal	

Excellent 5; Very Good 4; Good 3; Fair; Poor 1

Item	*Evaluation Criteria*	*5*	*4*	*3*	*2*	*1*	***Actual Marks***
1.	*Introduction and Rationale (Background, Problem statement and aims/ objectives)*			3			3
2.	*Literature Review (Relevance, recent developments, and organization of issues, etc)*				2		2
3.	*Research Methodology (appropriateness of methods and experimental design, etc)*		4				4
4.	*Feasibility of study and preliminary results (suitability to scope, aims, resources, outcomes and practicality)*			3			3
5.	*Expertise of PI/ Co-PI (expertise, publications and networking)*			3			3

6.	*Impact on Socio-Economic issues*			3			3
7.	*Budget*		4				4
8.	*Overall performance (presentation skills, pro activeness and confidence in Q & A session etc)*		4				4
			Total				26

Overall Decision	***Satisfactory***	***Satisfactory****	***Unsatisfactory***
	✓	***With minor amendments/ comments to improve***	***(less than 20 marks)***

Signature of Panel Member:

Name of the Panel Member : Dr B.M Nagabhushana Date: 23.03.2022

Title of the project:

Comments:

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Bangalore 560 054

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Comments on the Proposal Submitted for Research & Development Fund

Title: In silico and in vitro screening of natural products for Triple Negative Brest Cancer

PI: Dr. M Vidya

Comments: The proposal aims at in silico screening for exploring novel therapeutics for triple negative breast cancer. The objectives are clear and the research design is well identified. There are some queries which need to be addressed.

1. Literature report of specific studies carried out with regard to insilico screening of phytocompounds as anticancer agents is missing with emphasis on breast cancer cell lines. The research gap should be identified based on this.
2. The deliverables have to be stated.

I recommend the consideration of this proposal for presentation.

22/3/22

Dr. Chandraprabha M N

Prof and Head

Department of Biotechnology

Ramaiah Institute of Technology

Bangalore

RAMAIAH
College of Arts, Science
& Commerce

Research and Development Fund

Format for submitting the Research Proposal

Name of the Principal Investigator	Dr. M. Vidya
Qualification	Ph.D
Affiliation	Ramaiah College of Arts, Science and Commerce
Department	Chemistry and Biochemistry
Address , Phone Number and e-mail	Ramaiah College of Arts, Science and Commerce, Bengaluru Ph: +91 9008488931 vidya_biochem@msrcasc.edu.in
Papers Published in the research area (Attach brief profile)	4

Name of the Co-investigator	Dr. Krishna Murthy
Qualification	Ph.D
Department	Biotechnology
Affiliation	Ramaiah Institute of Technology
Address , Phone Number and e-mail	Ramaiah Institute of Technology, Bengaluru Ph: +91 95385 41385 krishnamurthytp@msrit.edu
Papers Published in the research area (Attach brief profile)	10

1. Title of the Proposal: **In silico and In vitro screening of natural products for Triple Negative Breast Cancer**
2. Broad Area of Research – **Drug discovery and Development**
3. Sub Area of Research – **Bioinformatics and Natural Products**

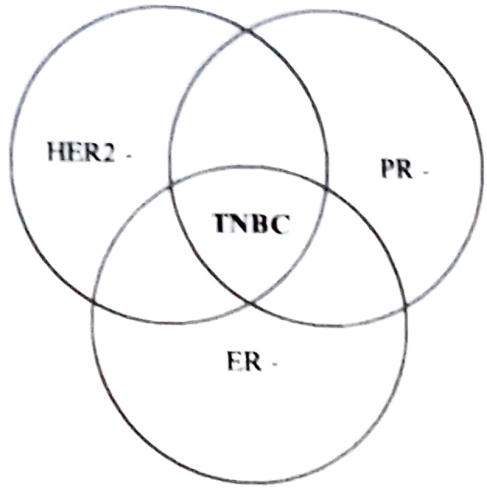
4. Brief Introduction (Max 500 words)

Introduction

Breast cancer is a heterogeneous disease with clinical, histological, and molecular subgroups. Triple negative breast cancer (TNBC) is a highly metastasized, heterogeneous illness that accounts for 15% of all instances of breast cancer and is defined by tumours that do not express oestrogen receptor (ER), progesterone receptor (PR), or overexpress human epidermal growth factor receptor 2 (HER2) [1]. Because the cancer cells lack these proteins, hormone therapy and drugs that target HER2 are not helpful, so chemotherapy (chemo) is the main systemic treatment option and although TNBC tends to respond well to initial chemo, it tends to come back (recur) more frequently than other breast cancers. Within the first 3–5 years of follow-up, TNBC is linked to a poor prognosis and a significant chance of distant recurrence and death. Given the aggressive nature of TNBC, a precise diagnosis is critical for assessing prognosis and ensuring that patients receive the best possible treatment [2].

Computer-aided drug design (CADD) approaches are becoming increasingly important in drug development, and they are vital in identifying viable therapeutic candidates at a low cost. These computational tools are useful for reducing the usage of animal models in pharmacological research and for assisting in the rational development of novel and safe drugs, supporting pharmacologists and medicinal chemists during drug discovery process [3].

Medicinal herbs and their derivative phytocompounds are being increasingly recognized as useful complementary treatments for cancer. The anticancer properties of plants have been recognized for centuries [4]. A large volume of clinical studies have reported the beneficial effects of herbal medicines on the survival, immune modulation, and quality of life (QOL) of cancer patients [5]. The anticancer characteristics of a number of plants are still being actively researched and some have shown promising results. In the present study, we are focusing on the natural phytocompounds in Triple Negative Breast Cancer Cells in in silico studies.



(Adopted from Damaskos etal 2019 [6]

5. Background and statement of the problem (this in the light of a thorough National and International literature review)..... (Max 500 words)

Background of the study

Breast cancer is the most common cancer among women worldwide, and it is the second largest cause of mortality after lung cancer (23 percent of all new cancer cases) [7]. TNBC is a breast cancer phenotype in which the oestrogen and progesterone receptors are negative, as shown by immunohistochemistry (IHC), and there is no overexpression of HER2 as determined by IHC or no gene amplification as determined by the fluorescence in situ hybridization technique [8]. TNBC has a higher propensity for aggressive behaviour than other kinds of breast cancer. There are no approved targeted treatments for advanced TNBC that expresses programmed cell death ligand 1, unlike other breast cancer subtypes (ER-positive, HER2 positive). However, immunotherapy (in combination with chemotherapy) is feasible for those with advanced TNBC that expresses programmed cell death ligand 1, (PD-L1). TNBC is more typically found in women under the age of 40 [9].

One of the most significant global concerns is the development of effective cancer therapies. Conventional cancer medicines have been at the forefront of the fight against cancer, but natural herbs have been used for cancer treatment in most parts of the world for centuries [10]. The beneficial effects of plant based active components

in cancer treatment have been extensively researched and have yielded promising results. Furthermore, various studies and research have demonstrated the beneficial effects of plants in the treatment of various diseases. Finding plant based active components that replace chemotherapy and cumbersome cures of cancer with cytotoxic effects is necessary.

With in silico methods playing a rising role in the development of commercialised medications, computational tools have become an essential aspect of most drug discovery processes. Computational techniques can be used at various stages of the process, from target selection to hit detection and optimization [11]. In silico methods are primarily utilised in conjunction with the creation of in vitro data to construct and test the model. The development and optimization of novel compounds with affinity for a target, as well as the elucidation of absorption, distribution, metabolism, excretion, and toxicity features, as well as physicochemical characterisation, have all benefited from such models. The development of novel treatments is a difficult, expensive, and time-consuming process. With the number of approved pharmaceuticals gradually decreasing and costs rising, a reasonable method to facilitating, expediting, and streamlining the drug discovery process is required [12].

In the present study, natural products in the functional databases will be screened for best docking score against the selected target. In vitro studies will be conducted with natural product showing best docking score on Triple negative breast cancer cell line. An anticancer drug will be used as a positive control. The cytotoxic effect of the natural product will also be tested in normal cell line. This study will highlight a potential anticancer candidate from a natural source.

6. Research question or hypothesis, aim and objectives.....(Max 300 words)

Aims and Objectives

The current study aims to explore novel therapeutic targets for Triple negative breast cancer. The systematic protocol of this study involves integration of bioinformatics and in silico approaches for hypothesis generation. Finally, the research findings of the aforementioned computational procedures will be validated under in vitro conditions.

Objectives

1. To derive gene signatures specific for Triple negative breast cancer
2. Computer aided screening of natural products (derived from microbes, marine algae, plants etc) against selected drug targets.
3. Anticancer activity of selected active component(s) in Triple negative breast cancer cell line (MDA-MB-231 Cells).

7. Research design (type of study)… (Max 300 words)

Research Design

The research design comprises three phases: In Phase 1, Bioinformatic techniques will be used to decipher the disease-specific targets that underpin the pathogenic condition. In phase 2, Selected phytoactives will be screened against the identified targets in computer modelling studies to uncover prospective Triple Negative Breast Cancer target-specific medicines. In vitro investigations will be used to validate the cytotoxicity of practically every nominated medication in Phase 3.

Phase 1: Identification of the Target

Combined analysis of microarray datasets:

The combined analysis helps to find leading information on the differences between TNBC and Non-TNBC in gene expression. The microarray data will be retrieved from the Gene Expression Omnibus (GEO) database (http://www.ncbi.nlm.nih.gov/geo) will be integrated into the current study (Barrett et al., 2013) with keywords "Triple negative Breast Cancer and Breast cancer". We will be selecting only the unique microarray data sets that examined gene expression profiling of Breast cancer which include Non-TNBC and TNBC in human (Yang et al., 2014).

Analyzing the microarray data sets with GEO tool:

Gene Expression Omnibus is a worldwide open storehouse that libraries and easily dispenses of high throughput purposeful genomics data, microarray data, and next-generation sequencing data to the research community. We will be using Gene Expression Omnibus to compare TNBC and Non-TNBC microarray datasets in direction to categorize genes that are differentially expressed across experimental conditions.

Subsequently, the microarray raw data will be translated to expressional data using GEO2R. Significant Differentially expressed genes between TNBC and Non-TNBC will be identified. The threshold for selecting the Differentially expressed genes will be set at adjusted P-value <0.05 and Log FC>2.

Construction and visualization of protein–protein interaction (PPI) network:

PPI cascades which are considered as crucial regulators of cellular biological processes will be captured to identify Differentially expressed genes between each group.

Gene set enrichment analysis of cross-talk genes

GO and KEGG enrichment analyses will be performed using Cytoscape software with the ClueGO-V2.1.7-plugin to investigate the involvement of cross-talk genes in cellular processes, biological processes, molecular functions, and pathways.

Phase-2: Computational simulation studies to explore potential drugs

Molecular docking to unveil the interaction between selected TNBC target and drugs

MMGBSA analysis

MMGBSA analysis will be performed to estimate the binding free energies (ΔGbind) of the best docked compounds. The compounds with high binding energies will be shortlisted for further evaluation

Molecular dynamic simulation

The shortlisted compounds post-MMGBSA analysis will be further subjected to Molecular Dynamics (MD) simulation studies

Phase-3: In vitro experimental validation to confirm cytotoxicity of identified drug

MTT assay

The drug which was shortlisted via aforementioned virtual techniques will be tested experimentally for its cytotoxic potential by carrying out MTT assay on Triple negative breast cancer cell line.

SRB Assay

The sulforhodamine B assay remains one of the most widely used method for in vitro cytotoxicity.

8. Study population and sampling (If applicable) –

NA

9. Data collection methods and instruments (Max 300 words)

- Computational work station for screening of natural products
- Fluorescent microscopy
- UV spectrophotometer

10. Data analysis methods – if applicable statistical planning must be fully addressed, or the candidate should provide evidence that statistics are not required

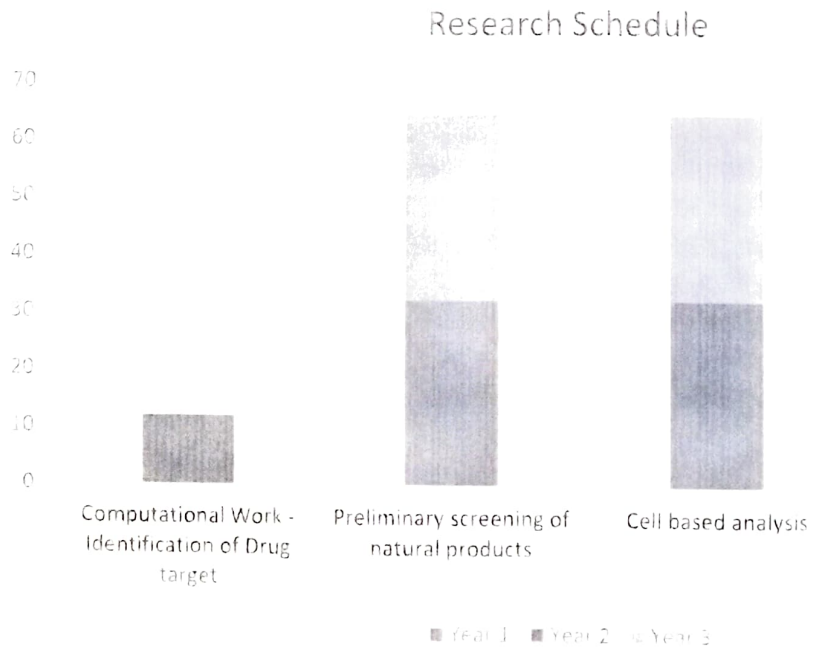
ANOVA analysis, Students t test, DMRT test will be used in the study wherever applicable

11. Mechanisms to assure the quality of the study – e.g. control of bias, safe storage of data….(Max 300 words)

Each methodology will be studied with positive and negative controls. A standard anticancer drug will be used as positive control against which group treated with natural product will be compared. The efficacy of the natural product will also be tested against normal noncancerous cell line.

For combined analysis of microarray datasets, we will select only the unique microarray data sets that examined gene expression profiling of Breast cancer which include Non-TNBC and TNBC in human.

12. Research Schedule -Bar chart for completion of the project



13. Participants in the study – all people involved in the study, and the role they play, should be identified.*

Not Applicable

14. Ethical considerations - (Max 300 words)

Not Applicable

15. Environmental Issues (Max 300 words)

Not Applicable

16. Resources required for the study, including budget (Personnel, Consumables, Equipment, Travel, Subcontracting, Provisions, Licensing fees, other).....

Sl. No	Item	BUDGET			Amount (In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	Equipment	Nil	Nil	Nil	Nil
2.	Consumables				200000
3.	Research Assistant	-	-	-	-
4.	Travel	10000	15000	15000	40000
5.	Other costs	5000	10000	10000	25000
6.	Analysis cost	-	40000	60000	100000
7.	Procuring Active constituent	-	100000		100000
	Grand total				465000

16.1. Justification for the manpower requirement : NA

16.2. Justification for consumable : Materials needed for research project, chemicals like MTT (3-(4,5-Dimethylthiazol-2-yl)-2,5-Diphenyltetrazolium Bromide), Sulphorhodamine B

16.3. Justification for Equipment : NA

16.4. Justification for other costs : Analysis by third party labs, procurement of active constituent to test its efficacy.

17. Scientific Impact, dissemination and potential exploitation (Max 300 words)

- To gain mechanistic insight into the identification of consistently differentially expressed gene products in Triple negative breast cancer.

- The consistently differentially expressed gene products identified definitely has clinical significance and can beeffectively exploited in targeted therapy for Triple negative Breast cancer.
- Computer aided screening of natural products (derived from microbes, marine algae, plants etc). will identify a novel therapeutic target for Triple negative cancer cell line.
- Current study will highlight a potential anticancer drug candidate for Triple negative breast cancer.

18. References……(Max 50)

1. Yin L, Duan J-J, Bian X-W, Yu S-c. Triple-negative breast cancer molecular subtyping and treatment progress. Breast Cancer Research. 2020;22:61.
2. Reddy SM, Barcenas CH, Sinha AK, Hsu L, Moulder SL, Tripathy D, et al. Long-term survival outcomes of triple-receptor negative breast cancer survivors who are disease free at 5 years and relationship with low hormone receptor positivity. British journal of cancer. 2018:118:17-23.
3. Brogi S, Ramalho TC, Kuca K, Medina-Franco JL, Valko M. Editorial: In silico Methods for Drug Design and Discovery. Frontiers in Chemistry. 2020;8.
4. Desai AG, Qazi GN, Ganju RK, El-Tamer M, Singh J, Saxena AK, et al. Medicinal plants and cancer chemoprevention. Current drug metabolism. 2008;9:581-91.
5. Yin SY, Wei WC, Jian FY, Yang NS. Therapeutic applications of herbal medicines for cancer patients. Evid Based Complement Alternat Med. 2013;2013:302426.
6. Damaskos C, Garmpi A, Nikolettos K, Vavourakis M, Diamantis E, Patsouras A, et al. Triple-Negative Breast Cancer: The Progress of Targeted Therapies and Future Tendencies. Anticancer Res. 2019;39:5285-96.
7. Cokkinides V, Albano J, Samuels A, Ward M, Thum J. American cancer society: Cancer facts and figures. Atlanta: American Cancer Society. 2005.
8. Brenton JD, Carey LA, Ahmed AA, Caldas C. Molecular classification and molecular forecasting of breast cancer: ready for clinical application? J Clin Oncol. 2005;23:7350-60.
9. Ismail-Khan R, Bui M. A Review of Triple-Negative Breast Cancer. Cancer control : journal of the Moffitt Cancer Center. 2010;17:173-6.
10. Liu W, Yang B, Yang L, Kaur J, Jessop C, Fadhil R, et al. Therapeutic Effects of Ten Commonly Used Chinese Herbs and Their Bioactive Compounds on Cancers. Evidence-Based Complementary and Alternative Medicine. 2019;2019:6057837.
11. Leonard J, Namasivayam V, Poongavanam V, Kannan S. In Silico Approaches for Drug Discovery and Development. In: editor^editors, editor;2017.p.3-74.
12. Ekins S, Mestres J, Testa B. In silico pharmacology for drug discovery: methods for virtual ligand screening and profiling. British journal of pharmacology. 2007;152:9-20.

19. Appendices (copy of questionnaire, consent forms, etc.)

NA

*Note 1: ***All proposals are subject to initial screening. If a proposal passes initial screening it is formally accepted as an application and will enter a second screening stage comprising of a high powered committee.***

*Note 2: Submit the completed form (both hard and soft copy) to the Principal, RCASC

Endorsement from the Head of Department*
(To be given on letter head)

Project Title: In silico and In vitro screening of natural products for Triple Negative Breast Cancer

1. Certified that the Department welcomes participation of **Dr. Vidya M, RCASC** as the Principal Investigator and **Dr. Krishna Murthy, RIT** as the Principal Co-Investigator for the Project and that in the unforeseen event of discontinuance by the Principal Investigator, the Principal Co-Investigator will assume the responsibility of the fruitful completion of the Project.

Date: 06.12.2021
Place: Bangalore

Name and Signature of Head of Department

Certificate from the Investigator

Project Title: In silico and In vitro screening of natural products for Triple Negative Breast Cancer

1. I/ We agree to abide by the terms and conditions of the research grant.

2. I/ We did not submit the Project proposal elsewhere for financial support.
3. I/ We have explored and ensured that equipment and basic facilities will actually be available as and when required for the purpose of the Projects.
4. I/ We undertake that on permanent equipment will be made available to other users during spare time.

Date: 06.12.2021
Place: Bangalore

Dr. M. VIDYA
Name and signature of Principal Investigator

Date: 06.12.2021
Place: Bangalore

Name and signature of Co- Investigator
Dr. T P Krishna Murthy.

The above project is Approved / Not Approved

Comments:

Signatures of the committee Members

Signature of the Principal

1.

2.

3.

Reviewed by Dr. B.M. Nagabhushana
30.02.2022

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund
Format for submitting the Research Proposal

Name of the Principal Investigator	Mr. Bharath K. Devendra.
Qualification	M.Sc., (Ph.D.) Thesis submitted.
Affiliation	M.S. Ramaiah College of Arts, Science and Commerce.
Department	Chemistry/Biochemistry
Address , Phone Number and e-mail	Department of Chemistry, M.S. Ramaiah College of Arts, Science and Commerce, MSR Nagar, MSRIT Post, Bengaluru-54 Mob:9900334993 Email ID:bharathkdevendra@gmail.com
Papers Published in the research area (Attach brief profile)	Electrodeposition, Corrosion Science, Hydrogen Generation and Photocatalyst.

NO attachment

Name of the Co-investigator	Dr. R Hari Krishna
Qualification	M.Sc, Ph.D.,
Department	Chemistry
Affiliation	M.S. Ramaiah Institute of Technology
Address , Phone Number and e-mail	Department of Chemistry, M.S. Ramaiah Institute of Technology, MSR Nagar, MSRIT Post, Bengaluru-54 Mob:9886434109 Email ID:rhk.chem@msrit.edu
Papers Published in the research area (Attach brief profile)	Nanomaterials, Materials Chemistry and Luminescence Spectroscopy.

No profile is attached.

1. Title of the Proposal: **"Advanced Strategies for Hydrogen Generation and Photocatalyst Applications using Noble Metal Catalysts"**

2. Broad Area of Research: **Photocatalyst and Hydrogen Generation.**

3. Sub Area of Research: **Corrosion Science**.

Research area & Sub are mismatching.

4. **Brief Introduction:** More than 150 years earlier, Elkington, who received a patent in 1837 [1]and later Bijttger, developed the first experiments on the electrolytic deposition of platinum group metals[2]. Platinum, palladium, rhodium, ruthenium, iridium, and osmium are members of the platinum group metals (PGM). Only platinum, palladium, and rhodium have previously found significant use in the electrodeposited condition [3]. The main disadvantage of

Comment: May be continued after presentation and clarifications

30-02-2022

this alloy coating is its high cost; however, its benefits include excellent chemical and oxidation resistance, as well as high strength, the main resistance to corrosion at high temperatures, are present in different areas such as the production of glass [4] and nitrogen fertilizers [5,6], thermocouples [7],automotive catalysts [9], jewellery [9,10] etc. Despite being one of the fastest electrocatalytic reactions, the hydrogen evolution reaction (HER) requires high noble metal loadings (0.5–1.0 mg/cm^2). It requires optimization of the extent of catalyst loading in order to reduce the cost of the electrode. Redox reactions at electrode and solution interfaces are becoming increasingly important in modern science and technology, as they decide the efficiency of a variety of electrochemical devices to be used in the future for sustainable renewable energy (11-15). Efficiencies of electrolysers and fuel cells are mainly determined by the effectiveness of interface between catalytic electrodes and electrolytes (16-21). However by using latest technology and art, only around 4% of hydrogen is produced from water electrolysis (22-24). It is mainly due to lack of design of the electrodes that leads to less production of hydrogen with high over voltage leading to high energy loss. In producing 15 trillion moles of hydrogen per year (4%), the average price is EUR 0.1kWh in the US and Europe (25-27). These costs of production are higher than that for production of hydrogen using noble metal as catalysts. By using the proper knowledge in noble metal coating, production of hydrogen is economically viable method (28-29). The amount of noble metals on the coating is very important parameter and by using proper knowledge small amount noble metals in the coating reduces the cost effect and gives the highest amount of hydrogen gas. The electrochemical method for dye pollution treatment has recently received a lot of attention, owing to its ease of automation, high sustainability, and environmental friendliness [30-31].The traditional methods were inadequate to purify the wastewater, simply moving the compounds from aqueous to another phase, causing secondary pollutants [32].Photocatalysis in presence of Noble metal like platinum is considered as the best method for effluent treatment. Effluents can be converted into potable water with platinum as a catalyst is a simple and effective method. Pulse Electrodeposition is considered a more efficient method of Electroplating compare to the DC method of Electrodeposition. In the PC method, based on the required current can be controlled by the ON and OFF method. In ON time current is passed into the time it is switched off. During OFF time more time will be given to nucleation and which reduces the nuclei size and give the uniform crystalline size

5. Background and statement of the problem (this in the light of a thorough National and International literature review):

Dyes are extensively used in textiles, paper, rubber, plastics, leather, cosmetics, pharmaceuticals and food industries resulting in a steady growth of demand and production. Today there are more than 10,000 synthetic dyes available commercially and more than 7×105 tonnes are produced annually (Torres et al. 2010; Joo et al. 2007). Synthetic dyes usually have a complex aromatic molecular structure which possibly comes from coal tar based hydrocarbons such as benzene, naphthalene, anthracene, toluene, xylene, etc. (Mishra &Tripathy 1993). From an environmental point of view, the disposal of synthetic dyes is of great concern (Golob et al. 2005).

The discharge of dye-bearing wastewater into natural streams and rivers from industries create severe problems. One of the most serious environmental problems of the present day is the cleaning of wastewater. The colour of wastewater prevents re-oxygenation by cutting off penetration of sunlight. It also increases the BOD and cause lack of dissolved oxygen. In addition, most of the dyes even in very low concentration are toxic to some microorganisms and also to aquatic life and cause direct destruction or inhibition of their catalytic capabilities. Many dyes are difficult to degrade as they are resistant to aerobic digestion. Dyes can also cause allergic dermatitis and skin irritation. Some of them have been reported to be carcinogenic and mutagenic. Hence a contamination due to dyes is not only a severe public health concern but also may cause serious environmental problems because of their persistence. This upsets the biological activities in water bodies.

According to the National Association of Corrosion Engineers International India section (NACE), the annual direct loss cost of corrosion may be 4% of the Gross Domestic Product (GDP), which is estimated to be around Rs.350 billion dollars per year. In this connection, the solution to reduce this phenomenal loss is to ensure that industries take up corrosion prevention as an important issue even at the design state. It is apparent that a person working in the field of corrosion is responsible not only for the protection of the products, equipment and welfare of the individuals but also for providing this at reasonable cost

The extensive consumption of fossil fuels over the past century has led to serious concerns like global warming, ozone layer depletion and acid rain. A long term energy supply solution that is practical, low cost, and clean is required. Renewable energy sources such as solar, wind currently cannot be used directly as fuel and require a storage medium because of their intermittent nature. Among the many choices, hydrogen has been identified as a potential energy carrier that can be stored, transported and distributed. Hydrogen is the most abundant element on earth and is considered as a leading candidate as energy carrier. However, elemental hydrogen is not available in substantial quantity on earth and is found in combination with carbon in hydrocarbons and with oxygen in water. Hydrogen is not a source of energy, but only a carrier of energy and requires technology to be produced (Barbir 2005a). Hydrogen generated on-site using a variety of

technologies could lead to development of decentralized micro power plants and vehicles basedon hydrogen (fuel cells, internal combustion engine utilizing hydrogen) would dramatically reduce emissions of particulates, carbon monoxide, sulphur and nitrogen oxides and other local pollutants as the only by product of combustion is water (Dunn 2002) A well-established method of deriving hydrogen is electrolysis, which involves the use of electricity to split water into hydrogen and oxygen atoms. At present, roughly 4 % of the world's hydrogen is derived from the electrolysis of water (Committee on) This process produces extremely pure hydrogen in small amounts

Research question or hypothesis, aim and objectives:

Optimization of noble metal bath solution and desired coating by electrodeposition method. Studying the growth nucleation mechanism of the selected noble metals and characterization of the samples. Desired coated samples are subjected to the corrosion studies, electrocatalytic hydrogen generation and dye degradation by photocatalyst.

6. Research design (type of study):

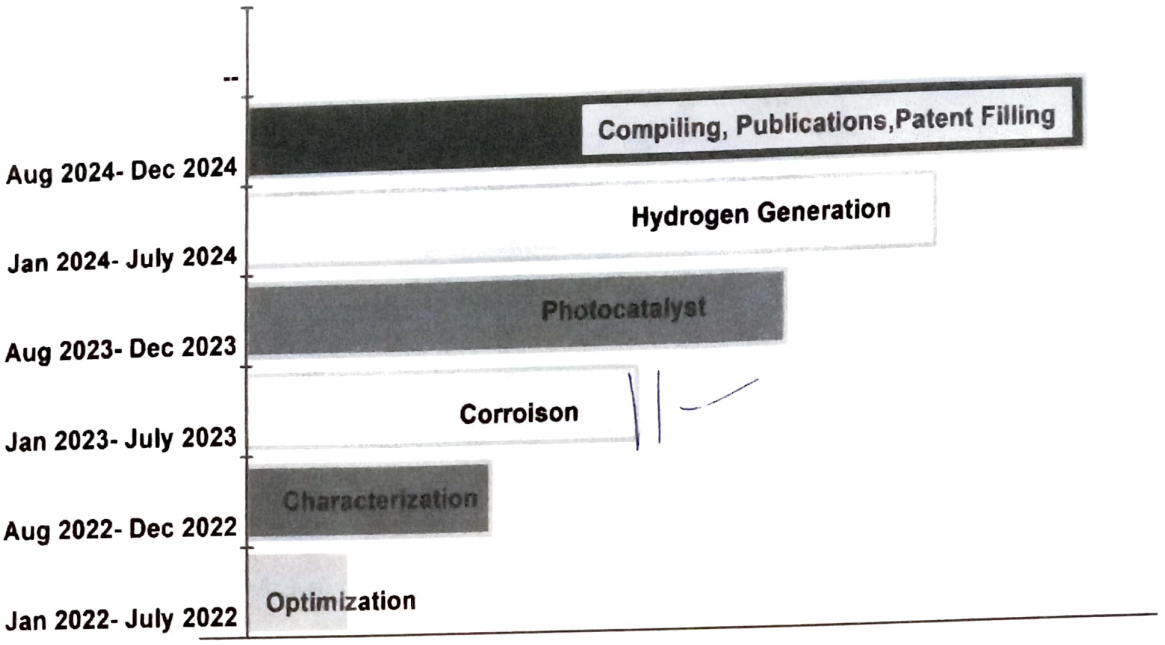
a) Purchase of equipment and chemicals.

a) Setting up of experiment.
b) Optimization of bath constituents.
c) Preparation of representative oxide layers on the surfaces of structural materials, such as SS304/SS316.
d) Noble metal electrodeposition on steel surface.
e) Optimization of electroplating process for getting the desired coating.
f) Cyclic voltammetry and chronoamperometry study for understanding the mechanism of electrodeposition.
g) Surface morphology analysis by SEM, AFM, and XRD.
h) Evaluation of corrosion behaviour and applications towards hydrogen generation and dye degradation by photocatalyst technique.
i) Compiling of all the results.
j) Patent filling and Publishing the results in reputed journals.

7. Study population and sampling (If applicable) : **N/A**
8. Data collection methods and instruments: **N/A**
9. Data analysis methods – if applicable statistical planning must be fully addressed, or the candidate should provide evidence that statistics are not required
10. Mechanisms to assure the quality of the study: **N/A**

— objectives are not defined properly

11. Research Schedule -Bar chart for completion of the project:



12. Participants in the study – all people involved in the study, and the role they play, should be identified.*:

PI role: Involvement in conceptualization, methodology, visualization, investigation, software, data curation and writing-original draft.

Co-PI Role:Involvementin methodology, formal analysis, resources, project administration, data curation, investigation and article writing.

13. Ethical considerations:

In our study, no peoples or animals were required in a way that is harmful to society.

14. Environmental Issues:

Chemical disposal measures will be fallowed as per the Institution rules and regulations and Environmental Protection Agency's safety standard.

15. Resources required for the study, including budget (Personnel, Consumables, Equipment, Travel, Subcontracting, Provisions, Licensing fees, other)……

Sl. No	Item	BUDGET			Amount (In Rupees)
and		1st Year	2nd Year	3rd Year	Total
1.	Equipment	3,00,000	----	----	3,00,000
2.	Consumables	1,00,000	50,000	25,000	1,75,000
3.	Research Assistant	N/A	N/A	N/A	N/A
4.	Travel	5,000	----	----	5,000
5.	Other costs	15,000	15,000	10,000	40,000
	Grand total	**4,20,000**	**65,000**	**35,000**	**5,20,000**

15.1. Justification for the manpower requirement: **N/A**

15.2. Justification for consumable: **Noble metals, dyes, reagents, etc. all this will be used as chemicals. Also anode and working electrode like SS/MS (Stainless Steel/Mild Steel) during plating.**

15.3. Justification for Equipment:**For Electrodeposition (DC/PC Plating source) and Spectrophotometer for Photocatalyst technique.**

15.4. Justification for other costs:**Characterization of samples and Contingencies**.

16. Scientific Impact, dissemination and potential exploitation:

This invention involves the field of electrodeposition of metals. More precisely, it relates to the process of obtaining noble metal coating by both DC and PC methods and it can be distinguished by SEM, XRD, EDX, XPS etc. Conclusion evidence favors in PC samples to reduce the crystalline size more compare to the DC samples and results in finest coating can be developed for the PC duty cycle. For dyes, which is present in the textile industries, Noble metals exhibits higher photodegradation and has a great potential application in wastewater treatment. All in all, one day electrodeposited metal and alloy-coated samples will replace the existing methods which are suitable for waste management, water disinfection. Developed noble metals coatings can show same trend similar to that of pure platinum towards HER.These coatings are economical and maybe used for commercial applications in production of hydrogen. Contribution of noble metals towards corrosion mitigation is highly noticeable by the researchers [33-35].

18. **References**: All are old references

1.E. Laister, Metal Ind., 1954;85:427-469.

2. E. Preston, Platinum in the glass industry. Platinum Met. Rev., 1960;4:48-55.

3. B. Fischer, Reduction of platinum corrosion in molten glass. Platinum Metals Rev., 1992;36:14-25.

4. Y. Ning, Z. Yang, H.Zhao, Platinum recovery by palladium alloy catchment gauzes in nitric acid plants. Platinum Met. Rev., 1996;4:80-87.

5.N. Yuantao, Y. Zhengfen, Platinum loss from alloy catalyst gauzes in nitric acid plants. Platinum Met. Rev., 1999;43:62-69.

6. B.Trumić, D. Stanković, V. Trujić, Examining the surfaces in used platinum catalysts. Journal of Mining and Metallurgy, 2009;45:79-87.

7. B. Wu, G. Liu, Platinum: Platinum-rhodium thermocouple wire. Platinum Met. Rev., 1997;41:81-85.

8.M. Funabikia, T.Yamadaa, K.Kayanoa, Auto exhaust catalysts.Catal. Today, 1991;10:33-43.

9.T. Biggs, S.Taylor, E. Van der Lingen, The hardening of platinum alloys for potential jewellery application. Platinum Met. Rev., 2005;49:2-15.

10.J. Wright, Jewellery-related properties of platinum: Low thermal diffusivity permits use of laser welding for jewellery manufacture. Platinum Metals Rev., 2002;46:66-72.

11. Norskov J, Bligaard K, Rossmeisl T, Christensen C.H (2009) Towards the computational design of solid catalysts. Nat. Chem.**1**:37–46.

No new reference

12. M.T.M. Koper (2011)Structure sensitivity and nanoscale effects in electrocatalysis .Nanoscale 3:2054–2073.https://doi.org/10.1039/C0NR00857E
13. StephensIfan E.L, BondarenkoAlexnader S, Gronbjerg U, Rossmeisl J, Chorkendorff I (2012)Understanding the electrocatalysis of oxygen reduction on platinum and its alloys. Energy Environ. Sci.**5**:6744–6762. https://doi.org/10.1039/C2EE03590A
14.Mokhtar M, Ohlinger O, Schlander H, Turek T (2001)Hydrogenolysis of dimethyl maleate on Cu ZnO/Al_2O_3catalysts.Chemical Engineering & Technology. 24. https://doi.org/10.1002/1521-4125(200104)24:4<423::AID-CEAT423>3.0.CO;2-G
15. JeongEun Y, Abdulohsen Ali A, Shanshan Q, Salem Mohamed B, Mohamed Mokhtar M.M, Narasimharao K, Dominik F, Jochen S, nca M, Nikita D, Gihoon G, Karsten M, Patrik S (2020) Establishing High Photocatalytic H_2 Evolution from MultiwalledTitanate Nanotubes.ChemCatChem.12:2951-2956. https://doi.org/10.1002/cctc.202000281
16. Symes Mark D, Cronin L (2013) Decoupling hydrogen and oxygen evolution during electrolytic water splitting using an electron-coupled-proton buffer. Nat. Chem.**5**, 403–409. https://doi.10.1038/NCHEM.1621
17. AliaksandrBandarenka S, Marc.T.M. Koper (2013) Structural and electronic effects in heterogeneous electrocatalysis: Toward a rational design of electrocatalysts. J. Catal.308:11–24.https://doi.org/10.1016/j.jcat.2013.05.006
18. Holewinski A, Xin H, Nikolla E, Linic S (2013) Identifying optimal active sites for heterogeneous catalysis by metal alloys based on molecular descriptors and electronic structure engineering. Current opinion in Chem. Eng. **2:**312–319. https://doi.org/10.1016/j.coche.2013.04.006
19.Jakub T, Federico Calle-Vallejo, Wolfgang S, AliaksandrBandarenka S(2016)Making the hydrogen evolution reaction in polymer electrolyte membrane electrolysers even faster.Nature communications. https://doi.org/10.1038/ncomms10990
20. Mohsen S, Seyedsina H, Shiva M, Ondrej T, Mohamed Mokhtar, Abdulmohsen A, Sohrab S, Radek Z, Patrik S (2019) Photocatalytic H_2 Evolution: Dealloying as Efficient Toolfor the Fabrication of Rh-decorated TiO_2 Nanotubes.ChemCatChem.**11**:6258-6262. https://doi.org/10.1002/cctc.201901183

21. JeongEun Y, Marco A, Mohamed M, Abdulmohsen A.A, Al-Thabaiti S.A, Anca M, PatrikSchmuki (2016) Photocatalytic H_2 Generation Using Dewetted Pt-Decorated TiO_2 Nanotubes: Optimized Dewetting and Oxide Crystallization by a Multiple Annealing Process. The Journal of Physical chemistry C. **120**. DOI: 10.1021/acs.jpcc.5b12050
22. NagiRadwan R.E, Mokhtar M, El-Shobaky G.A (2003) Surface and catalytic properties of CuO and Co_3O_4 solids as influenced by treatment with Co^{2+} and Cu^{2+} species. Applied Catalysis A: General. **241**:77-90.DOI:10.1016/S0926-860X(02)00459-3

23. Bicakova O, Straka P (2012) Production of hydrogen from renewable resources and its effectiveness. International Journal of Hydrogen Energy.**37:**11563–11578.DOI: 10.1016/j.ijhydene.2012.05.047
24. Ahmed N. S,__ Menzel R, _Wang Y, Garcia- G.A,Bawaked S.M, Obaid A.Y, Basahel S.N, Mokhtar M (2017) Graphene-oxide-supported CuAl and CoAl layered double hydroxides as enhanced catalysts for carbon-carbon coupling via Ullmann reaction. Journal of Solid State Chemistry.**246**:130-137. https://doi.org/10.1016/J.JSSC.2016.11.024

25. El-Shobaky G.A, Ahmad A.S, Mokhtar M (1997) Effect of gamma-irradiation on surface and catalytic properties of CuO-ZnO/Al_2O_3 system. Journal of radioanalytical and nuclear chemistry.**219**:89-94.Doi: 10.1007/bf02040271

26. Carmo M, David. Fritz L, Mergel J, Stolten D (2013) A comprehensive review on PEM water electrolysis. International Journal of Hydrogen Energy.**38**:4901–4934. https://doi.org/10.1016/j.ijhydene.2013.01.151
27. Subbaraman, R. Dusan T, Dusan S, Kee-Chul C, Masanobu U, Arvydas P, Vojislav S, Nenad M(2011) Enhancing hydrogen evolution activity in water splitting by tailoring Liþ-$Ni(OH)_2$-Pt interfaces. Science. **334**:1256–1260. https://doi: 10.1126/science.1211934
28. Yin, H. J. Shenlong Z, Kun Z, Abdul M, Hongjie T, Lin C, Huijun Z, Yan G, Zhiyong T. (2015) Ultrathin platinum nanowires grown on single-layered nickel hydroxide with high hydrogen evolution activity. Nat. Commun. **6**:6430. https://doi: 10.1038/ncomms7430.
29. Yang, X. F. Aiqin W, Botao Q, Jun L, Jingyue L, Tao Z(2013) Single-atom catalysts: a new frontier in heterogeneous catalysis. Acc. Chem. Res. **46**:1740–1748.
30. E. Chatzisymeon, A. Dimou, D. Mantzavinos, A. Katsaounis (2009) J. Hazard. Mater.,167:268 274.
31. S. Fierro, C. Comninellis (2010) Kinetic study of formic acid oxidation on Ti/IrO2 electrodes prepared using the spin coating deposition technique. Electrochimica. Acta 55:7067–7073 .https://doi.org/10.1016/j.electacta.2010.06.066
32. I. D. Santos, M. Dezotti, A.J.B. Dutra (2013) Electrochemical treatment of effluents from petroleum industry using a Ti/RuO2 anode.Chem. Eng. J., 226:293–299. https://doi.org/10.1016/j.cej.2013.04.080
33. B.K. Devendra, B.M. Praveen, V.S. Tripathi, D.H. Nagaraju, K.O. Nayana, Hydrogen Evolution Reaction by Platinum Coating. Iranian Journal of Science and Technology, Transactions A: Science, 45, 1993-2000 (2021). https://doi.org/10.1007/s40995-021-01220-2
34. B.K. Devendra, B.M. Praveen, V.S. Tripathi, D.H. Nagaraju and K.O. Nayana. Pt-Rh Alloy Catalysts for Hydrogen Generation developed by Direct Current/Pulse Method. Journal of Iranian Chemical Society, 1-10 (2021). https://doi.org/10.1007/s13738-021-02433-3
35. B.K. Devendra, B.M. Praveen, V.S. Tripathi, G. Nagaraju, D.H. Nagaraju, K.O. Nayana. Highly Corrosion Resistant Platinum-Rhodium alloy coating and its photocatalytic activity. Inorganic Chemistry Communications, 109065. https://doi.org/10.1016/j.inoche.2021.10906

19. Appendices (copy of questionnaire, consent forms, etc.)

*Note 1:***_All proposals are subject to initial screening. If a proposal passes initial screening it is formally accepted as an application and will enter a second screening stage comprising of a high powered committee._**

*Note 2:Submit the completed form(both hard and soft copy) to the Principal, RCASC

Endorsement from the Head of Department*
(To be given on letter head)

1. **Project Title: "Advanced Strategies for Hydrogen Generation and Photocatalyst Applications using Noble Metal Catalysts"**

Certified that the Department welcomes participation of Mr **Bharath K. Devendra** as the Principal Investigator and **Dr. R. Hari Krishna** as the Principal Co-Investigator for the Project and that in the unforeseen event of discontinuance by the Principal Investigator, the Principal Co-Investigator will assume the responsibility of the fruitful completion of the Project.

Date: 30/11/2021

Place: Bengaluru.

S. G. Prasanna

Prasanna Kumar. S.G.

Name and Signature of Head of Department

Head of the Department
CHEMISTRY / BIO-CHEMISTRY
M.S. Ramaiah College of Arts,
Science & Commerce
Bangalore - 560 054

Certificate from the Investigator

Project Title:

1. I/ We agree to abide by the terms and conditions of the research grant.

2. I/ We did not submit the Project proposal elsewhere for financial support.
3. I/ We have explored and ensured that equipment and basic facilities will actually be available as and when required for the purpose of the Projects.
4. I/ We undertake that on permanent equipment will be made available to other users during spare time.

Date: 30/11/2024
Place: Bengaluru

Bharath K. Devendra.
Name and signature of PrincipalInvestigator

Date: 30/11/2024
Place: Bangalore

Dr. R. Hari Krishna
Name and signature of Co- Investigator

The above project is Approved / Not Approved

Comments:

Signatures of the committee Members

1.

2.

3.

Signature of the Principal

Reviewed by Dr B.M. Nagabhushana
30.03.2022

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund

Format for submitting the Research Proposal

Name of the Principal Investigator	**Dr. SHASHIDHAR BHARADWAJ S.**
Qualification	M.Sc., Ph.D.
Affiliation	M. S. Ramaiah College of Arts, Science and Commerce
Department	CHEMISTRY
Address , Phone Number and e-mail	Department of Chemistry – PG RCASC M.S.R.I.T Post, Bengaluru – 560054 drbharadwaj21@gmail.com
Papers Published in the research area (Attach brief profile)	**07** Nos. – Peer Reviewed UGC journals NO attachment

Name of the Co-investigator	**Dr. SAMRAT K**
Qualification	Assistant Professor
Department	Department of Biotechnology
Affiliation	MSRIT
Address , Phone Number and e-mail	MSR Nagar, MSRIT Post Bangalore, PIN- 560 054 Karnataka INDIA Email : samrat@msrit.edu
Papers Published in the research area(Attach brief profile)	**10** Nos. NO attachment

Commants: old references are listed, the out come and novelty of the research investigation is expected during presentation. If candidate is effectively answered, project may be considered for funding.
Dr Nagabhushana
30.3.2022

1. Title of the Proposal... **"Design, Synthesis and Evaluation of Quinoline Hybrids as Novel Inhibitors against the *P. Falciparum Dihydrofolate Reductase* (*Pfdhfr*) of Possible Promising Antimalarial: Investigation of Antimalarial Activities"**
2. Broad Area of Research **"Bio-Organic and Medicinal Chemistry"**
3. Sub Area of Research **"Organic Chemistry"**

4. ***Brief Introduction*.....*(Max 500 words)***

Development of a lead molecule and a much effective drug (having low molecular weight with desired properties) against known targets, has been a challenging work. Nowadays, drug discovery has significantly scooped up, due to the availability of sophisticated 3D X-ray images, NMR structures of biomolecules, docking tools and advancing towards computer aided methodologies.

Malaria is one of the most widespread and deadliest diseases that resulted in 212 million clinical cases and 429,000 deaths in 2015 alone, It has estimated that in every year 200 million people will get disease globally according to the World Health Organization (WHO) report.

Malaria is usually caused by protozoan parasites of the genus Plasmodium including *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi* species of human malaria parasite. In particular, *P. falciparum* is the most fatal one, which is responsible for 95% of the case of death. The life cycle of malaria parasites is rather complex. Hereinto, the erythrocytic stage is responsible for the diverse symptoms caused by infection. It is known that hemoglobin degradation and hemozoin formation are essential for parasite survival, making these processes important targets for antimalarials development. Heme detoxification into hemozoin was believed to be the main target of quinoline antimalarials and remained one of the most attractive drug development targets.

Looking for the structures with propitious/providential bioactivity, many chemists focused their investigation on quinoline and its congeners which have surprisingly came up as diverse and potent antimalarial drugs. Quinoline as a core moiety, containing some fused heterocyclic rings as antimalarial drugs ever used are Mefloquine, Quinacrine, Chloroquine, hydrochloroquine, Amodiaquine, Quinine, Primaquine, Pamaquine, Pentaquine, Isopentaquine, Pyrimethamine, Tafenoquine and Piperaquine.

The literature reveals that Quinoline hybrids acts against the malaria parasites by blocking haemozoin formation through π-π stacking of the substituted quinoline core to the heme ring system or by docking into grooves on the haemozoin crystal and preventing further crystal growth. The toxic haematins then leave the digestive vacuole and enter into the parasite cytosol where oxidative membrane damage is induced.

In order to substantiate the observed activity profile and to provide insight into the mechanisms of action of the hybrids, molecular docking studies can be performed into the binding pocket of P. falciparum dihydrofolate reductase (PfDHFR) considering both the wild type (1J3I.pdb) and a quadruple mutant (N51I, C59R, S108 N, I164L, 3QG2.pdb).

5. **Background and statement of the problem (this in the light of a thorough National and International literature review) ..... (Max 500 words)**

The present-day scenario is to encourage the growth of high-quality interdisciplinary research, which now thrive in many institutions. In this context the proposed project interfaces the chemistry and biology and thus has the interdisciplinary relevance. Novel Quinoline hybrids will be synthesized by making use modern synthetic technique and the resulting molecules will be screened for their antimalarial properties. Review of status of Research and Development in the subject. A new group of highly active quinoline hybrids have set new standards in medicine and malarial with respect to efficacy and range of disease control spectrum. Among this group, we find the most active compounds known today for control of Plasmodium including *P. Falciparum, P. vivax, P. malariae, and P. ovale.*

6. **Research question or hypothesis, aim and objectives..... (Max 300 words)**

The proposed work of synthesizing novel heterocyclic compounds having quinoline are expected to display better antimalarial activity. The findings of the research outcome will be published as and when data is available in leading international and national journals with an intention to disseminate the knowledge and the project is intended to explore the possibility of understanding the malarial properties of the molecules designed for the synthesis. Synthesis of these heterocycles and their malarial data would be useful in making the proper conclusion of the proposed work.

The objective of this proposal is to synthesis quinoline hybrids, to substitute the chlorine atom by halogenated aryloxy groups, to screen the above synthesized

compounds against Plasmodium including *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi* and to understand the effects quinoline hybrids and halogenated aryloxy substituents attached quinoline hybrids,to characterize the compounds by FT-IR, NMR, LC-MASS and single crystal X-ray spectral studies, to screen the above synthesized compounds through Molecular docking studies and investigate the binding pocket of *P. falciparum dihydrofolate reductase* (*PfDHFR*).

7. **Research design (type of study) ..... (Max 300 words)**

1. To synthesis quinoline hybrids.
2. To substitute the chlorine atom by halogenated aryloxy groups.
3. To screen the above synthesized compounds against Plasmodium including *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi* and to understand the effects quinoline hybrids and halogenated aryloxy substituents attached quinoline hybrids.
4. To characterize the compounds by FT-IR, NMR, LC-MASS and single crystal X-ray spectral studies.
5. To screen the above synthesized compounds through Molecular docking studies and investigate the binding pocket of *P. falciparum dihydrofolate reductase* (*PfDHFR*).

8. **Study population and sampling (If applicable) .....**

The present work is based on to screen the above synthesized compounds against Plasmodium including *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi* and to understand the effects of quinoline hybrids and halogenated aryloxy substituents attached quinoline hybrids.

9. **Data collection methods and instruments..... (Max 300 words)..**

a. <u>Synthesis quinoline hybrids</u>

Synthesize a substituted chlorine atom by halogenated aryloxy groups and characterize the compounds by FT-IR, NMR, LC-MASS and single crystal X-ray spectral studies.

b. <u>Biological activity</u>

To screen the above synthesized compounds against Plasmodium including *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi* and to understand

the effects quinoline hybrids and halogenated aryloxy substituents attached quinoline hybrids.

c. ***In silico* Molecular Docking studies**

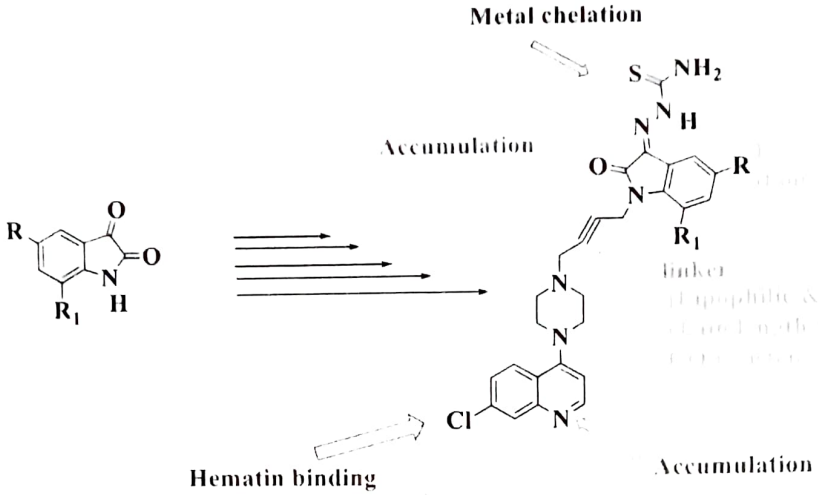
To screen the above synthesized compounds through Molecular docking studies and investigate the binding pocket of *P. falciparum* dihydrofolate reductase (PfDHFR).

10. **Data analysis methods – if applicable statistical planning must be fully addressed, or the candidate should provide evidence that statistics are not required**

In the proposed project the synthesized products will be characterized by the following methods and techniques

a. Synthesis of *N*- propargylated isatin 7-chloroquinoline hybrids via Cu-mediated Mannich reaction
b. HPLC and Chromatographic techniques for the separation of compounds.
c. Characterization by Spectroscopic techniques like FTIR, ^{1}H-NMR, ^{13}C-NMR, Elemental analyses, Single crystal XRD and LC Mass
d. Screening of the synthesized compounds through Molecular docking studies and investigate the binding pocket of p. *falciparum dihydrofolate reductase* (pfDHFR).
e. Screening of the synthesized compounds against Plasmodium including P. *Falciparum, P. vivax, P. malariae, P. ovale and P. knowlesi* and to understand the effects quinoline hybrids.

11. **Mechanisms to assure the quality of the study – e.g. control of bias, safe storage of data…. (Max 300 words)**



Binding pocket of
***P. falciparum dihydrofolate reductase* (PfDHFR)**

12. **Research Schedule -Bar chart for completion of the project.....**

The work distribution for 24 months will be as follows:

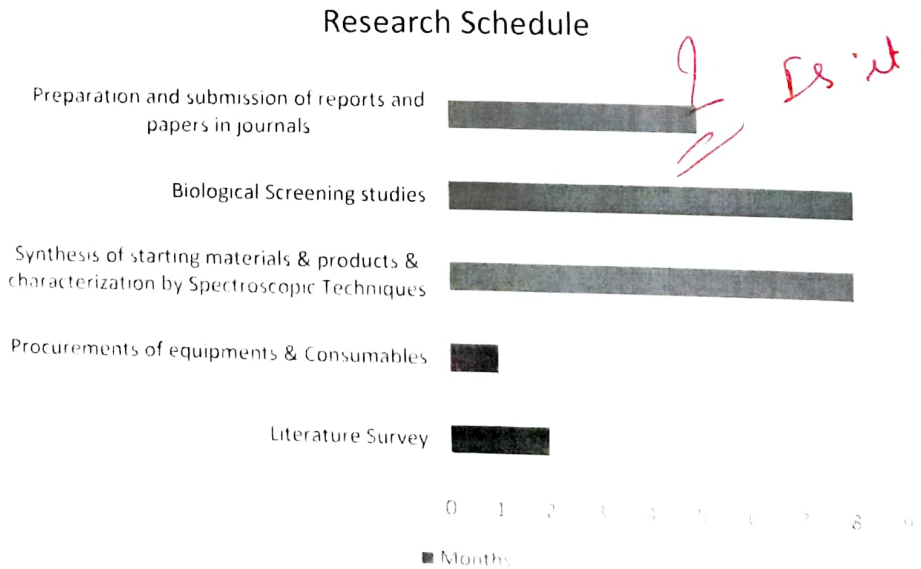
a) Literature Survey - **2** months

b) Procurements of equipment's & consumables - **1** months

c) Synthesis of the starting materials & products & characterization by Spectroscopic Techniques - **8** months

d) Biological screening studies - **8** months

e) Preparation and submission of reports and papers in journals - every **5** months



13. **Participants in the study – all people involved in the study, and the role they play, should be identified.*.....**

1. *Dr. Shashidhar Bharadwaj S. (PI) & Prof. Sridhar Rajaram (Co-PI) -Designing and planning of experiments/Analysis of the results
2. Dr. Shashidhar Bharadwaj S. and M.Sc/Ph.D students - Bench work
3. Dr. Shashidhar Bharadwaj S.- Corresponding author of the technical report and manuscript.

The Role of Co-PI ?

14. **Ethical considerations.....(Max 300 words)**

Not Applicable

15. **Environmental Issues.....(Max 300 words)**

Not Applicable

16. **Resources required for the study, including budget (Personnel, Consumables, Equipment, Travel, Subcontracting, Provisions, Licensing fees, other).....**

Sl. No	Item	BUDGET			Amount (In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	Equipment	**1.** TLC-UV Cabinet **2.** Magnetic Stirrer With Hot Plate temp controller with rpm **3.** rotary evaporator **4.** Glass wears **5.** TLC plates			2.0 Lack

2.	Consumables	1. Starting material Chemicals 2. Reagents 3. Solvents 4. Catalyst 5. Magnetic stirrer	Repealed		2.0 Lack
3.	Research Assistant	Nil	Nil		
4.	Travel	Nil	Nil		
5.	Other costs		Outsourcing samples for characterization by Spectroscopic and Biological screening studies		1.00 Lack
	Grand total	4 Lacks	1 Lack		**5 Lacks**

a. Justification for the manpower requirement:

Project work will be accomplished as M.Sc students projects and also for expected Ph.D. fellows from RUSA

b. Justification for consumable:

Consumable of this project mainly include heating mantel, condenser, R.B flask, Beakers, test tubes, funnels, TLC plates, UV light chamber etc. These are the essential requirements and planned to get from vendor with minimum cost without compromising with the quality of the product

c. Justification for Equipment:

Minimum equipment required for putting a reaction in the lab is proposed. Fuming wood will be used from M.Sc. chemistry lab. To monitor the completion of reaction with the help of TLC, UV light chamber is used which needs to be set up in the organic lab.

d. Justification for other costs:

Outsourced samples for other experiments including the assay for the above synthesized compounds against Plasmodium including *P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale* and *P. knowlesi* can be done

17. **Scientific Impact, dissemination and potential exploitation (Max 300 words)**

Malaria is one of the most widespread and deadliest diseases that resulted in 212 million clinical cases and 429,000 deaths in 2015 alone. It has estimated that in every year 200 million people will get disease globally according to the World Health Organization (WHO) report. Malaria is usually caused by protozoan parasites of the genus Plasmodium including *P. falciparum*, *P. vivax*, *P. malariae*, *P. ovale* and *P. knowlesi* species of human malaria parasite. In particular, *P. falciparum* is the most fatal one, which is responsible for 95% of the case of death. The life cycle of malaria parasites is rather complex. Hereinto, the erythrocytic stage is responsible for the diverse symptoms caused by infection. It is known that hemoglobin degradation and hemozoin formation are essential for parasite survival, making these processes important targets for antimalarials development. Heme detoxification into hemozoin was believed to be the main target of quinoline antimalarials and remained one of the most attractive drug development targets.

Project result will be presented in national and international conferences and communicated to UGC listed journals

18. **References……(Max 50)……**

No new references

1. J. Greer, J. W. Erickson, J. J. Baldwin, M. D. Varney, *J. Med. Chem.*, 1994, **37**, 1035-1054.
2. B. A. Muller, *Curr. Pharm. Des.*, 2009, **15**, 120-133.
3. T. Chua, C. L. Moore, M. B. Perri, S. M. Donabedian, W. Masch, D. Vager, S. L. Davis, K. Lulek, B. Zimnicki, M. J. Zervos, *J. Clin. Microbiol.*, 2008, **46**, 2345-2352.
4. D. T. Chu, J. J. Plattner, L. Katz, *J. Med. Chem.*, 1996, **39**, 3853-3874.
5. S. Kumar, S. Bawa, H. Gupta, *Mini Rev. Med. Chem.*, 2009, **9**, 1648-1654.
6. K. Kaur, M. Jain, R. P. Reddy, R. Jain, *Eur. J. Med. Chem.*, 2010, **45**, 3245-3264.

7. Y. L. Chen, Y. L. Zhao, C. M. Lu, C. C. Tzeng, J. P. Wang, *Bioorg. Med. Chem.*, 2006, **14**, 4373-4378.

8. G. Ramaprasad, B. Kalluraya, B. S. Kumar, S. Mallya, *Med. Chem. Res.*, 2013, **22**, 5381-5389.

9. N. Ingale, V. Maddi, M. Palkar, P. Ronad, S. Mamledesai, A. Vishwanathswamy, D. Satyanarayana, *Med. Chem. Res.*, 2012, **21**, 16-26.

10. B. Jayashankar, K. L. Rai, N. Baskaran, H. Sathish, *Eur. J. Med. Chem.*, 2009, **44**, 3898-3902.

11. H. Kumar, S. A. Javed, S. A. Khan, M. Amir, *Eur. J. Med. Chem.*, 2008, **43**, 2688-2698.

12. C. Velázquez, P. P. Rao, R. McDonald, E. E. Knaus, *Bioorg. Med. Chem.*, 2005, **13**, 2749-2757.

13. C. Ainsworth, W. Buting, J. Davenport, M. Callender, M. McCowen, *J. Med. Chem.*, 1967, **10**, 208-211.

14. R. A. Rane, S. D. Borhade, P. K. Khandare, *Eur. J. Med. Chem.*, 2013, **70**, 49-58.

15. R. A. Rane, S. D. Gutte, N. U. Sahu, *Bioorg. Med. Chem. Lett.*, 2012, **22**, 6429-6432.

16. Y. Li, Y. Luo, Y. Hu, D. D. Zhu, S. Zhang, Z. J. Liu, H. B. Gong, H. L. Zhu, *Bioorg. Med. Chem.*, 2012, **20**, 4316-4322.

17. M. A. Bakht, M. S. Yar, S. G. Abdel-Hamid, S. I. Al Qasoumi, A. Samad, *Eur. J. Med. Chem.*, 2010, **45**, 5862-5869.

18. A. M. Dodiya, N. R. Shihory, N. Desai, *Synth. Commun.*, 2012, **42**, 3230-3241.

19. M. Amon, X. Ligneau, J. C. Schwartz, H. Stark, *Bioorg. Med. Chem. Lett.*, 2006, **16**, 1938-1940.

20. P. Tosco, M. Bertinaria, A. Di Stilo, C. Cena, G. Sorba, R. Fruttero, A. Gasco, *Bioorg. Med. Chem.*, 2005, **13**, 4750-4759.

21. S. Lorenzi, M. Mor, F. Bordi, S. Rivara, M. Rivara, G. Morini, S. Bertoni, V. Ballabeni, E. Barocelli, P. V. Plazzi, *Bioorg. Med. Chem.*, 2005, **13**, 5647-5657.

22. G. A. Gfesser, H. Zhang, J. Dinges, G. B. Fox, J. B. Pan, T. A. Esbenshade, B. B. Yao, D. Witte, T. R. Miller, C. H. Kang, *Bioorg. Med. Chem. Lett.*, 2004, **14**, 673-676.

23. J. Clitherow, P. Beswick, W. Irving, D. Scopes, J. Barnes, J. Clapham, J. Brown, D. Evans, A. Hayes, *Bioorg. Med. Chem. Lett.*, 1996, **6**, 833-838.

24. S. Joshi, Y. More, H. Vagdevi, V. Vaidya, G. Gadaginamath, V. Kulkarni, *Med. Chem. Res.*, 2013, **22**, 1073-1089.

25. M. J. Ahsan, J. G. Samy, H. Khalilullah, M. S. Nomani, P. Saraswat, R. Gaur, A. Singh, *Bioorg. Med. Chem. Lett.*, 2011, **21**, 7246-7250.

26. M. A. Ali, M. Shaharyar, *Bioorg. Med. Chem. Lett.*, 2007, **17**, 3314-3316.

27. G. S. Kumar, Y. Rajendraprasad, B. Mallikarjuna, S. Chandrashekar, C. Kistayya, *Eur. J. Med. Chem.*, 2010, **45**, 2063-2074.

28. R. R. Kumar, S. Perumal, J. C. Menéndez, P. Yogeeswari, D. Sriram, *Bioorg. Med. Chem.*,2011, **19**, 3444-3450.

29. K. P. Harish, K. N. Mohana, L. Mallesha, B. Veeresh, *Arch. Pharm.*,2014, **347**, 256-267.

30. S. Ubaradka, A. M. Isloor, P. Shetty, P. Shetty, N. A. Isloor, *Med. Chem. Res.*, 2013, **22**, 1497-1503.

31. H. Rajak, P. Singour, M. D. Kharya, P. Mishra, *Chem. Biol. Drug Des.*, 2011, **77**, 152-158.

32. J. W. Watthey, M. Desai, R. Rutledge, R. Dotson, *J. Med. Chem.*, 1980, **23**, 690-692.

33. Z. Li, P. Zhan, X. Liu, *Mini Rev. Med. Chem.*, 2011, **11**, 1130-1142.

34. R. Pratap, V. Yarovenko, *Nucleosides, Nucleotides, Nucleic Acids*, 2000, **19**, 845-849.

35. M. Kalhor, A. Dadras, *J. Heterocycl. Chem.*, 2013, **50**, 220-224.

36. L. Fernandez, M. Santo, M. Reta, L. Giacomelli, R. Cattana, J. Silber, M. Risso, H. Cerecetto, M. Gonzalez, C. Olea Azar, *Molecules*, 2005, **10**, 1197-1208.

37. S. Cao, X. Qian, G. Song, Q. Huang, *J. Fluorine Chem.*, 2002, **117**, 63-66.

38. W. Shi, X. Qian, G. Song, R. Zhang, R. Li, *J. Fluorine Chem.*, 2000, **106**, 173-179.

39. J. Sun, H. Zhu, Z. M. Yang, H. L. Zhu, *Eur. J. Med. Chem.*, 2013, **60**, 23-28.

40. A. S. Aboraia, H. M. A. Rahman, N. M. Mahfouz, M. A. E. Gendy, *Bioorg. Med. Chem.*, 2006, **14**, 1236-1246.

41. X. M. Zhang, M. Qiu, J. Sun, Y. B. Zhang, Y. S. Yang, X. L. Wang, J. F. Tang, H. L. Zhu, *Bioorg. Med. Chem.*, 2011, **19**, 6518-6524.

42. I. Khan, A. Ibrar, N. Abbas, *Arch. Pharm.*, 2014, **347**, 1-20.

43. S. Dash, B. A. Kumar, J. Singh, B. Maiti, T. Maity, *Med. Chem. Res.*, 2011, **20**, 1206-1213.

44. X. Ouyang, E. L. Piatnitski, V. Pattaropong, X. Chen, H. Y. He, A. S. Kiselyov, A. Velankar, J. Kawakami, M. Labelle, L. Smith, *Bioorg. Med. Chem. Lett.*, 2006, **16**, 1191-1196.

45. C. Feng, L. Wang, Y. Yan, J. Liu, S. Li, *Med. Chem. Res.*, 2012, **21**, 315-320.

46. K. L. Rai, N. Linganna, *Il Farmaco*, 2000, **55**, 389-392.

47. W. R. Tully, C. R. Gardner, R. J. Gillespie, R. Westwood, *J. Med. Chem.*, 1991, **34**, 2060-2067.

48. G. D. Diana, D. L. Volkots, T. J. Nitz, T. R. Bailey, M. A. Long, N. Vescio, S. Aldous, D. C. Pevear, F. J. Dutko, *J. Med. Chem.*, 1994, **37**, 2421-2436.

49. A. Milyutin, L. Amirova, V. Kolla, F. Y. Nazmetdinov, L. Drovosekova, Y. S. Andreichikov, *Pharm. Chem. J.*, 1998, **32**, 422-424.

50. R. R. Somani, A. G. Agrawal, P. P. Kalantri, P. S. Gavarkar, E. Clercq, *Int. J. Drug Des. Dis.*, 2011, **2**, 353-360.

19. **Appendices (copy of questionnaire, consent forms, etc.)**

Not Applicable

*Note 1: ***All proposals are subject to initial screening. If a proposal passes initial screening it is formally accepted as an application and will enter a second screening stage comprising of a high powered committee.***

***Note 2: Submit the completed form (both hard and soft copy) to the Principal, RCASC**

RAMAIAH
College of Arts, Science & Commerce

M S Ramaiah College of Arts, Science and Commerce
Re-accredited 'A+' by NAAC, Permanently Affiliated to Bengaluru Central University
Approved by Government of Karnataka, Approved by AICTE, New Delhi
Recognized by UGC under 2F & 12B of UGC act 1956

Endorsement from the Head of Department*

(To be given on letterhead)

Project Title: Project Title: Design, Synthesis and Evaluation of Quinoline Hybrids as Novel Inhibitors against the *P. Falciparum Dihydrofolate Reductase* (*Pfdhfr*) of Possible Promising Antimalarial: Investigation of Antimalarial Activities

1. Certified that the Department welcomes the participation of **Dr. Shashidhar Bharadwaj S.** as the Principal Investigator and **Dr. Samrat K.** as the Principal Co-Investigator for the Project and that in the unforeseen event of discontinuance by the Principal Investigator, the Principal Co-Investigator will assume the responsibility of the fruitful completion of the Project.

Date: 30-11-2021

Place: Bangalore

Name and Signature of Head of Department

Head of the Department
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Certificate from the Investigator

Project Title: Design, Synthesis and Evaluation of Quinoline Hybrids as Novel Inhibitors against the *P. Falciparum Dihydrofolate Reductase* (*Pfdhfr*) of Possible Promising Antimalarial: Investigation of Antimalarial Activities

1. I/ We agree to abide by the terms and conditions of the research grant.

2. I/ We did not submit the Project proposal elsewhere for financial support.

3. I/ We have explored and ensured that equipment and basic facilities will actually be available as and when required for the purpose of the Projects.

4. I/ We undertake that on permanent equipment will be made available to other users during spare time.

Date:

Place:

Dr. Shashidhar Bharadwaj. S.

Name and signature of Principal Investigator

Date:

Place:

DR. Samrat. K Samrat. K 18/06/21

Name and signature of Co- Investigator

The above project is Approved / Not Approved

Comments:

Signatures of the committee Members

Signature of the Principal

1.

2.

3.

Reviewed by Dr. B M Nagabhushana
20.02.2022

RAMAIAH
College of Arts, Science & Commerce

Research and Development Fund

The Research Proposal

Name of the Principal Investigator	Dr. Vibha Vinayakumar Bhat
Qualification	Ph.D.
Affiliation	M S Ramaiah College of Arts, Science and Commerce (MSRCASC)
Department	Chemistry
Address, Phone Number and e-mail	Department of Chemistry, MSRCASC, MSRIT Post, Bengaluru-560054 vibhamadhava@gmail.com
Papers Published in the research area	NO attached 4 International

Name of the Co-investigator	Mrs. Ramya Kumari B S
Qualification	MSc M.Phil. KSET (PhD)
Department	Biochemistry
Affiliation	M S Ramaiah College of Arts, Science, and Commerce (MSRCASC)
Address, Phone Number and e-mail	Dept. of Chemistry, MSRCASC MSRIT Post, Bengaluru-560054 ramyarr24@yahoo.co.in
Papers Published in the research area	Life Science (3 Publications)

NO attached map

Comments: Novelty statement is needed. Literature survey on proposed work is insufficient, Candidate may give justification during presentation, so grant may be given on satisfactory answer.

Dr Nagabhushana
20.02.2022

Title of the Proposal: Synthesis of fumaramide derivatives of Lanthanum (III) complexes and their screening for AChE and BuChE inhibition activities

1. Broad Area of Research: Chemistry
2. Sub Area of Research: Bioinorganic Chemistry

Brief Introduction

Alzheimer's disease is the most common form of neurodegenerative disease which is characterized by memory loss, cognitive decline and reduced ability to perform everyday activities. Based on cholinergic hypothesis current pharmacological drugs being synthesized are mainly aimed at increasing the level of neurotransmitter acetylcholine by the inhibition of cholinesterases (ChE)[1-3]. Current approaches to the treatment of cognitive and behavioral symptoms of Alzheimer disease emphasize the use of cholinesterase inhibitors. Hence the kinetic effects of the cholinesterase inhibitors donepezil, galantamine, metrifonate, physostigmine, rivastigmine, and tetrahydroaminoacridine were examined with respect to their action on the esterase and aryl acylamidase activities of human acetylcholinesterase (AChE) and human butyrylcholinesterase (BuChE). The comparative kinetic studies suggested that though the given drugs that are currently in use for the treatment of Alzheimer disease inhibit both AChE and BuChE, the development of drugs targeted toward the exclusive inhibition of one or the other cholinesterase may be important for understanding the relative importance of inhibition of BuChE and AChE in the treatment of this disease16. Recently oxamides and fumaramides were synthesized and their cholinesterase activities were evaluated. The results implied that the presence of an ethylene bridge in the fumaramide analogues had more influence on the inhibition of AChE and BuChE[2]. Though several organic compounds with N, O, S and carbonyl derivatives show potent cholinesterase inhibition activities, there is a scope for development of drugs showing site specific activity. Some of the ligands act as better metal chelators also. But the evidence for the metal complex which acts as enzyme inhibitor is very less. Thus, there is wide scope for the development of organic ligands and their metal complexes as site-specific enzyme inhibitors[2].

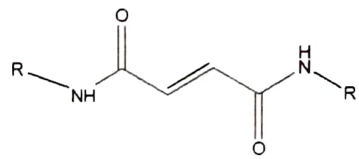
1. Background and statement of the problem

I have expertised in synthesizing oxamide derivatives and complexing them with La(III) metal.[4-7] The biochemical applications of La(III) oxamide complexes have been studied as my PhD thesis work wherein I worked on investigating the binding ability of La(III) complexes with CT-DNA, chemical nuclease activity with SC pUC 19 DNA, anticancer activities against

MCF-7 and *HeLa* cell lines, antibacterial activities, DPPH radical scavenging activities, metal chelation activities and so on. Based on this experience, I would like to investigate the enzyme inhibition activities of fumaramides and their La(III) complexes.

1. Research question or hypothesis, aim and objectives

The proposed project is focusing on the bioinorganic chemistry and the potential application of the ligands and their metal complexes in biological systems. The first strategy is the facile synthesis of fumaramide ligands having various substituted aromatic moiety containing electron withdrawing and electron donating groups.



Fumaramide

Then these ligands will be used to synthesize novel metal complexes containing La (III) as central metal ion. Next step is to characterize the newly synthesized ligands and the metal complexes using various spectrophotometric and elemental analyses techniques. Third and the most important part is to study/understand the biological importance of these ligands and complexes in cholinesterase enzyme inhibition activity which plays key role in preventing or slow down neurodegenerative disease like Alzheimer's disease. This enzyme inhibition activity will be tested by biochemical assays. The protein ligand/metal complex interaction in the active site pocket of the enzyme will be studied by molecular docking techniques. The importance of these studies comes from the very potent applications of these fumaramide ligands as well as the metal complexes as therapeutic agents in many Alzheimer's diseases.

2. Research design

1) Synthesis of fumaramide ligands and La(III) metal complexes by conventional methods

2) Structural characterization by spectroscopic and analytical methods

3) Investigation of biological activities: Protein binding studies, substrate inhibition assays – Kinetics studies

4) *In silico* screening of the molecules with AChE and BuChE enzymes

3. **Data collection methods and instruments**

The primary characterization techniques of these materials include single crystal X-ray diffraction (SCXRD), powder diffraction, UV Visible Absorption and Emission, Cyclic voltammetry, Conductometry, IR analysis, ^{1}H-NMR and ^{13}C – NMR, ESI-Mass Spectrometry (samples to be sent out for these analyses). The protein binding assays and biochemical assays will be carried out by using UV-visible spectrometer for the kinetics studies.

Note: Few of the instrumentation facilities will be availed and supported at Department of Chemistry, MSRIT Campus.

4. **Data analysis methods**

For this project the methods for data interpretation consist of Origin, MS Excel, Autodock and Autodock Vina.

Research Schedule-Bar chart for completion of the project:

1st Year	2nd Year	3rd Year	4th Year
Literature survey and Synthesis of ligands and complexes			
	Structural characterization and protein binding studies		
		Biochemical assays	
			In-silico screening of ligands and metal complexes

5. **Participants in the study**

Under graduate and post graduate students may work in this project as part of their internship, summer and winter projects, MSc project, and other academic activities.

6. **Ethical considerations**

Any scientific contribution to this work by a person or an institute will be acknowledged and the authorship will be shared if needed.

Mention any equipments needed

7. Resources required for the study, including budget

Sl. No	Item	BUDGET				Amount (In Rupees)
		1st Year	2nd Year	3rd Year	4th Year	Total
1.	Equipment #	2 lakhs	1 lakh	-	-	3 lakhs
2.	Consumables	20000.00	20000.00	20000.00	5000.00	65000.00
3.	Research Assistant	NA	NA	NA	NA	NA
4.	Travel	-	2500.00	2500.00	-	5000.00
5.	Other costs	6000.00	5000.00	5000.00	4000.00	20000.00
	Grand total	2.26 lakhs	1.275 lakhs	27500.00	9000.00	3.9 lakhs

7.1. Justification for consumable: For buying glass apparatus, specific chemicals such and solvents, Magnetic stirrer with hot plate, refluxing unit, BSA protein, enzymes, and substrates for biochemical assays

7.2. Justification for Equipment: The protein binding studies will be studies using the Melting point apparatus and Viscometer with Thermostat. is it 3 lakhs?

7.3. Justification for other costs: The samples may be sent out for other characterizations and charges are applicable for it. Other costs include the stationeries purchased for the lab.

8. Scientific Impact, dissemination and potential exploitation

Alzheimer's disease (AD) is the most common form of neurodegenerative disease that occurs in the central nervous system. The major causes for the disease can be attributed to the hydrolysis of neurotransmitter acetylcholine by the two enzymes acetyl choline esterase and butyryl choline esterase, aggregation of β-amyloid proteins which cause formation of plaques in the nerve cells etc. Rivastigmine, galantamine and donepezil only offer symptomatic relief and do not show any disease modifying effects. Tacrine has shown serious hepatotoxic effects. On viewing all these facts, we are focusing on the development of new molecules as potent drugs which show high efficiency and cause no or less side effects. Reduction in the activity of the cholinergic neurons is a well-known feature of Alzheimer's disease. We are focusing on evaluating the enzyme inhibition activity of these ligands and lanthanum (III) metal complexes against acetylcholine esterase and butyrylcholine esterase enzymes and thereby developing novel potent drugs for Alzheimer's disease.

9. References

1. Henryk Kozlowski, Marek Luczkowski, Maurizio Remelli, Daniela Valensin. *Coord. Chem. Rev.*, 2012.
2. Kadir Ozden Yerdelen, Edip Tosun. *Medicinal Chemistry Research*, 2015, 24, 588-602.
3. Alicja Skrzypek, Joanna Matysiak, Andrzej Niewiadomy, Marek Bajda, Pawel Szymanski. *Eur. J. Med. Chem.*, 2013, 62, 311-319.
4. Vibha Vinayakumar Bhat, P. R. Chetana, Fluorescence studies of Lanthanum (III) complexes of N, N′ bis-(alkyl/aryl)-substituted oxamides and phenanthroline bases, *Res. J. Chem. Env.*,2020, 24, 88 – 95.
5. P. R. Chetana, D. R. Navya, Vibha Vinayakumar Bhat, B. S. Srinatha, Mohan A. Dhale, Studies on DNA interactions and Biological Activities of Lanthanum(III) Complexes with 4-quinoline terpyridine and 1,10-phenanthroline. *Asian J. Chem.*, 2019, 6, 1265-1274
6. P. R. Chetana, Vibha Vinayakumar Bhat, Mohan A. Dhale, Hetero-binuclear complexes of lanthanum(III) using bridging N,N′-bis(2-pyridylmethyl)oxamide and terminal 1,10-phenanthroline: Syntheses, characterization and DNA interactions. *Int. J. Pharm. Sci. Drug Res.* 2018; 10(6): 460-473
7. P. R. Chetana, Vibha Vinayakumar Bhat, Mohan A. Dhale, DNA interactions, antibacterial and antioxidant studies of newly synthesized lanthanum(III) complexes using N,N′-bis(3-pyridylmethyl) oxamide and N,N-heterocyclic bases. *Int. J. Pharm. Sci. Rev. Res.* 2018, 49, 86-99

List of publications

1. **Vibha Vinayakumar Bhat**, P. R. Chetana, Fluorescence studies of Lanthanum (III) complexes of N, N′ bis-(alkyl/aryl)-substituted oxamides and phenanthroline bases, *Res. J. Chem. Env.*, 2020, 24, 88 – 95
2. P. R. Chetana, D. R. Navya, **Vibha Vinayakumar Bhat**, B. S. Srinatha, Mohan A. Dhale, Studies on DNA interactions and Biological Activities of Lanthanum(III) Complexes with 4-quinoline terpyridine and 1,10-phenanthroline. *Asian J. Chem.*, 2019, 6, 1265-1274
3. P. R. Chetana, **Vibha Vinayakumar Bhat**, Mohan A. Dhale, Hetero-binuclear complexes of lanthanum(III) using bridging N,N′-bis(2-pyridylmethyl)oxamide and terminal 1,10-phenanthroline: Syntheses, characterization and DNA interactions. *Int. J. Pharm. Sci. Drug Res.* 2018; 10(6): 460-473

4. P. R. Chetana, **Vibha Vinayakumar Bhat**, Mohan A. Dhale, DNA interactions, antibacterial and antioxidant studies of newly synthesized lanthanum(III) complexes using N, N′-bis(3-pyridylmethyl) oxamide and N,N-heterocyclic bases. *Int. J. Pharm. Sci. Rev. Res.* 2018, 49, 86-99.
5. **Ramya Kumari B. S**. "Ongoing Clinical and Immunization Trials for Novel Zoonotic Covid -19 Pandemic" *Sumerianz J. Biotech.*, 2021, Vol. 4, No. 2, pp. 85-93 ISSN(e): 2617-3050, ISSN(p): 2617-3123
6. Malla Sudhakar, **Ramya Kumari B. S.**, Poornashree M., Ankitha Gour, and Sahani Sultana and Saroj Mahala" Antiurolithiatic activity of neem leaves in existing renal calculi by invitro methods" *Eur. J. Biomed. Pharm. Sci.*, 2016, Vol. 3, issue.3 214-217.
7. Malla Sudhakar, **Ramya Kumari B. S.**, Kiran H K, Basavaraj M B, Gowthami K, Savitha M V, and Purushotham R "possible heavy metal (Pb, Mn, & Cu) accumulation in fresh water and waste water irrigated vegetables." *Eur. J. Biomed. Pharm. Sci.*, 2016, Vol.3 isuue.9, 167-170.

RAMAIAH
College of Arts, Science & Commerce

M S Ramaiah College of Arts, Science and Commerce
Re-accredited (A+) (2021) | Permanently Affiliated to Bengaluru Central University
Approved by Government of Karnataka | Approved by AICTE, New Delhi
Recognized by UGC under 2f & 12B of UGC act 1956

Endorsement from the Head of Department

Project Title: Synthesis of fumaramide derivatives of Lanthanum(III) complexes and their screening for AChE and BuChE inhibition activities

Certified that the Department welcomes participation of **Dr. Vibha Vinayakumar Bhat** as the Principal Investigator for the Project and that in the unforeseen event of discontinuance by the Principal Investigator, the Principal Co-Investigator (**Mrs. Ramya Kumari B S, Dept. of Chemistry**) will assume the responsibility of the fruitful completion of the Project.

Date: 31-11-2021

Place: Bengaluru

(H.O.D)

Mr. Prasanna Kumar S. G.

Head of the Department
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Certificate from the Investigator

Project Title: Synthesis of fumaramide derivatives of Lanthanum(III) complexes and their screening for AChE and BuChE inhibition activities

1. We agree to abide by the terms and conditions of the research grant.
2. We did not submit the Project proposal elsewhere for financial support.
3. We have explored and ensured that equipment and basic facilities will actually be available as and when required for the purpose of the Projects.
4. We undertake that on permanent equipment will be made available to other users during spare time.

Date: 31-11-2021
Place: Bengaluru

Dr. Vibha Vinayakumar Bhat (PI)

Mrs. Ramya Kumari B S (Co-PI)

The above project is Approved/ Not Approved

Comments:

Signatures of the committee Members

1.

2.

3.

Signature of the Principal

Reviewed by Dr B M Mahaveshwara
30-03-2021

RAMAIAH
College of Arts, Science & Commerce

DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY
Research Proposal

Name of the Principal Investigator	Dr. Hareesh Kumar P
Qualification	M Sc., Ph. D.,
Affiliation	M S Ramaiah College of Arts, Science and Commerce
Department	Chemistry/ Biochemistry
Address , Phone Number and e-mail	MSRIT Post, MSR Nagara, Mathikere, Bengaluru – 560054, 9663572041 hareesh.kp6@gmail.com
Papers Published in the research area(Attach brief profile)	Medicinal Chemistry, Organic Synthesis, Natural Product, Process development, Nano composites, Metallomesogens. I am having quite a substantial experience in synthesis and characterization of organic compounds during my Industrial and Research experience, for that I got eight publication out of which one is Indian patent and other one is book which is published in Lambert academic press, Germany very recently and all my publications are related to organic synthesis.

No attachment

Name of the Co-investigator	Mr. S G Prasanna Kumar
Qualification	M Sc.MPhil, D. Pharma (PhD)
Department	Chemistry/ Biochemistry
Affiliation	M S Ramaiah College of Arts, Science and Commerce
Address , Phone Number and e-mail	MSRIT Post, MSR Nagara, Mathikere, Bengaluru – 560054 8197132950 prasanna_chem@msrcasc.edu.in
Papers Published in the research area (Attach brief profile)	Material science, Nanomaterials, Organic Synthesis:

No profile is attached

Comments: No clarity in write-up. Candidate may give clarification during presentation. If satisfactory, seed money may be granted.

30-03-2021

1. Title of the Proposal: **Synthesis of analogues of Molnupiravir and their Anti – Covid - 19 activity**
2. add Area of Research Organic Synthesis, Medicinal and Process chemistry, Nano composites, Metallomesogens
3. Sub Area of Research: Organic Chemistry
4. Brief Introduction:

Mention only Broad area

World's first medicine to treat symptomatic Covid – 19 is Molnupiravir (1, EIDD-2801, MK-4482) is an orally active antiviral prodrug candidate that was discovered at Emory University. The active metabolite, β-D-N4 -hydroxycytidine (NHC, 2A/2B), was originally targeted for the treatment of hepatitis C (HCV) in the early 2000s.31 Molnupiravir has shown broad-spectrum activity against several RNA viruses, including influenza A and B, Ebola, norovirus, RSV, HCV, coronavirus, and Venzuelan equine encephalitis virus (VEEV). With the emergence of SARS CoV-2 in early 2020, focus rapidly shifted to the evaluation of molnupiravir for the treatment of SARS CoV-2.β-D-N4 -Hydroxycytidine acts by disrupting RNA synthesis. Incorporation of the molecule during viral RNA synthesis leads to subsequent base-pair misreading, resulting in high mutation rates and ultimately genome lethality. NHC exists as two tautomeric forms that have been shown to have similar energies in aqueous solution. A theoretical study suggested that the oxime tautomer 37B may base-pair with uracil (U), adenine (A), and guanine (G) while the hydroxylamine tautomer 37A mimics cytosine (C), which base-pairs with G, resulting in an assortment of mutations.35 In a study that examined the effect of NHC on viral guide RNA synthesis in VEEV, 8.9 mutations per 10 000 nucleotides were identified in media containing NHC versus only 0.85 mutations per 10 000 nucleotides in the control medium, a >10-fold increase. The majority of the mutations were transition mutations, with 4-fold more U-to-C or C-to-U than A-to-G or G-to-A.34 Molnupiravir has also been shown to have potent activity against SARS CoV-2 that is resistant to remdesivir. Oral treatment of molnupiravir to mice and ferrets infected with COVID-19 was effective in reducing viral load in the upper respiratory tract and in blocking transmission of the virus to untreated contact animals. The rights to molnupiravir were acquired by Ridgeback Biotherapeutics, which is now partnering with Merck to advance clinical trials for the treatment of SARS CoV-2. In October 2020, Merck initiated a Phase 2/3 trial in hospitalized patients with doses of 200, 400, and 800 mg twice daily for 5 days. with a target enrollment of 1300 patients. In March 2021, Merck and Ridgeback announced preliminary results from a Phase 2a study in 207 patients. The results of the primary end point, a reduction in time to viral negativity, were not disclosed. A secondary end point showed a reduction in time to negativity of infectious virus in nasopharyngeal swabs in patients with SARSCoV-2 infection.

5. Background and statement of the problem:

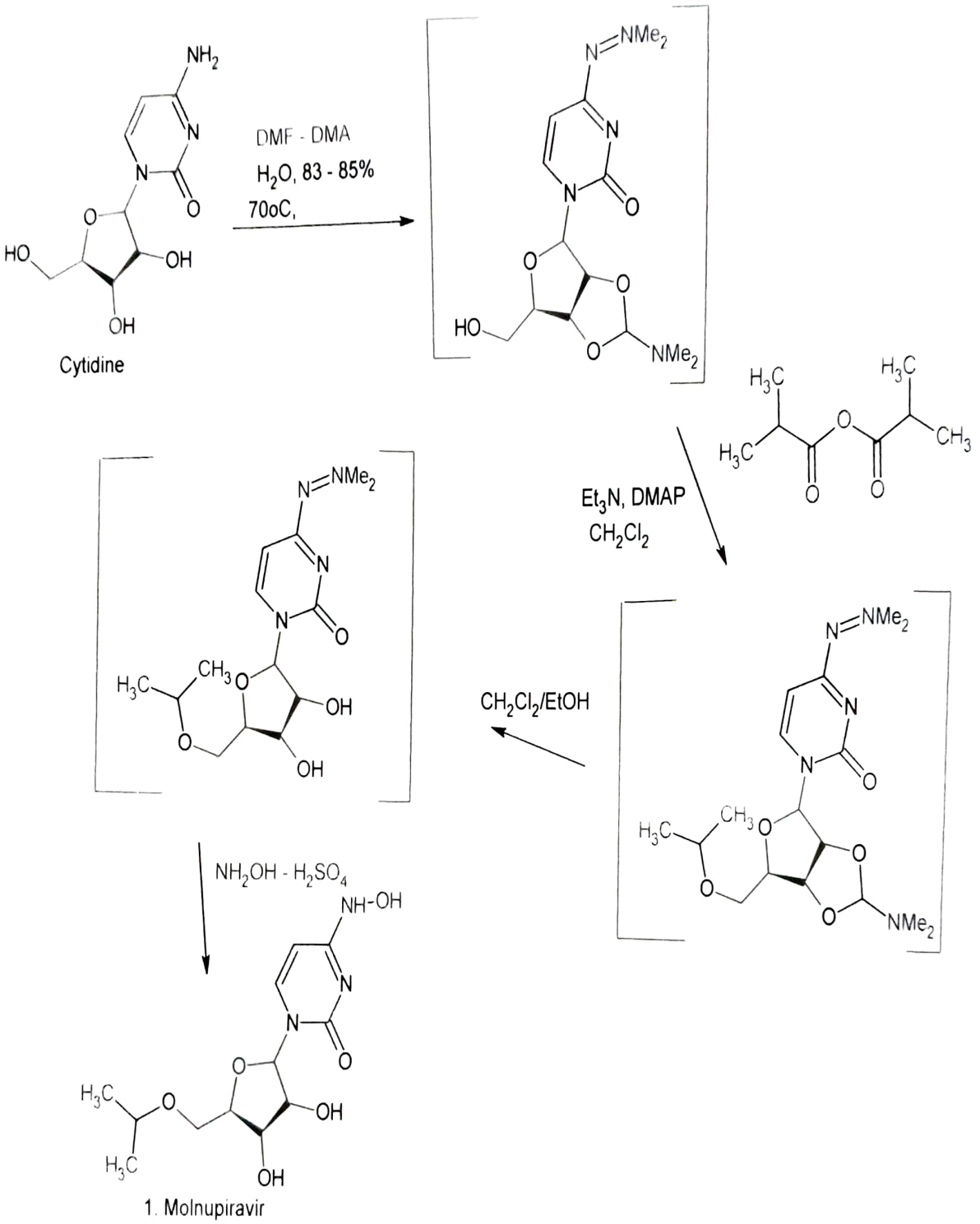
Coronaviruses are enveloped positive sense RNA viruses that cause a large percentage of respiratory illness in humans. The two previous coronaviruses to emerge and cause human illness were SARS and MERS, there were more than 8000

human cases of SARS with 774 deaths. Since 2012, there have been more than 2500 cases of MERS with 919 deaths, in 2019, a new coronavirus, 2019-nCoV and new known as SARS-CoV-2: was discovered in humans in Wuhan, China. Reports from early February 2020 indicate more than 28000 people have been infected with the novel coronavirus, with more than 560 deaths documented, in addition. Human – to-human transmission of 2019-nCoV has documented. Analysis of a single completed full – genome sequence revealed 2019-nCoV belongs to beta coronavirus but is divergent from SARS and MERS. The 2019-nCoV is a highly pathogenic human patghogen that relatively little is known about SARS-CoV-2/2019-nCoV causes disease referred to as Covid-19. Covid19 can include severe respiratory disease in humans and appears to also cause neurological disease that includes dizziness, impaired consciousness, acute cerebrovascular disease, epilepsy hyposmia and neuralgia (medRxiv, 2020, 1-26). SARS-CoV-2 entry into the CNS may be promoted through viral interaction with ACE2 receptors after dissemination of the virus in the systemic circulation or across the cribriform plate. Additional studies are needed to further characterize the virus and to identify ways to prevent and treat disease.
am being an Organic chemist, am looking at economically feasible efficient process for the preparation and Technology Transfer to manufacture of molnupiravir and their analogues development for better Bio efficacy and better economically viable product when compare to molnupiravir

6. Research question or hypothesis, aim and objectives:
Preparation of molnupiravir in existing method, process development for improvement in yield and filling Indian patent, transferring Technology to industry and preparation of novel method development, novel analogues preparation and their Biological activities such as anti – Covid – 19, anti – viral, anti – HIV, anti – Microbial, Anti – Mycobacterial activity, anti – cancer activity and etc

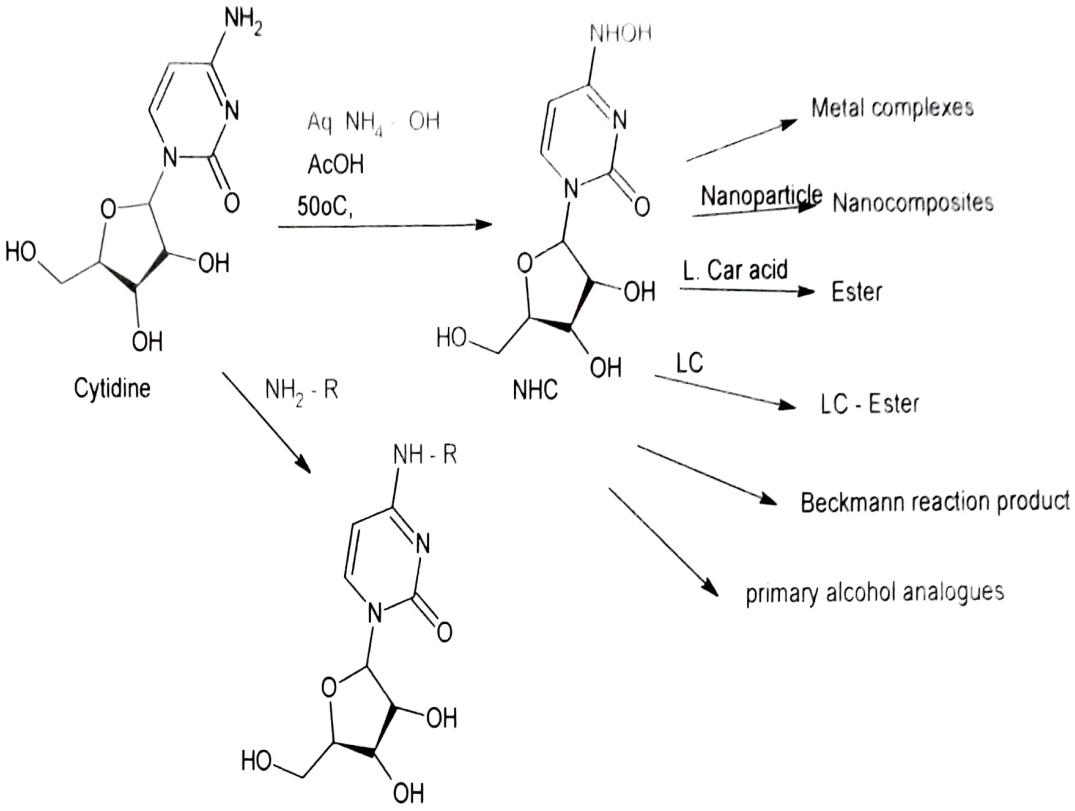
7. Research design:
   - It's mainly Organic synthesis, Process development, Patent filling, Technology transfer to higher scale preparation and making New Product development

The following existing method of scheme taking for the preparation of molnupiravir and here looking for process development more particularly in yield improvement, once I got, then process will be optimized then can make process patent.



Scheme: for preparation & Process development of Molnupiravir

- Following methodology, would like to involve in making new chemical entity of molnupiravir analogues



Where R= NH_2, Semicarbozide, etc

Scheme for preparation of anlogues of Molnupiravir

8. Study population and sampling (If applicable): NA
9. Data collection methods and instruments: IR, HRMS, H^1 NMR, C^{13}NMR, CHN analysis, XRD…etc.
10. Data analysis methods – if applicable statistical planning must be fully addressed, or the candidate should provide evidence that statistics are not required
11. Mechanisms to assure the quality of the study:
12. Research Schedule:
    - Procurement of chemical and glassware and instruments
    - Preparation of NHC or Molnupiravir
    - Process optimization of molnupiravir
    - Scale up of molnupiravir
    - Preparation of analogues of Molnupiravir their characterization, getting done of Biological activities- In vitro or in Vivo such as anti – Covid – 19 activity, anti – microbial, anti – bacterial, anti – HIV, anti – cancer etc.
    - Publications – We will Publish
13. Participants in the study – all people involved in the study, and the role they play, should be identified. * 9 PI Role and Co-pi Role
14. Ethical considerations: Studies will be done in the Laboratories who are having the ethical clearance from concerned authorities
15. Environmental Issues: Disposal will be done as per slandered operating procedure.

Budget is incomplete

16. Resources required for the study, including budget (Personnel, Consumables, Equipment, Travel, Subcontracting, Provisions, Licensing fees, other):

Sl. No	Item	BUDGET			Amount (In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	Equipment	2.30 Lakh	40000		
2.	Consumables	50000/			
3.	Research Assistant		01	01	
4.	Travel(for characterizations and other literature studies)	yes	yes	yes	2
5.	Other costs			2.0 Lakh	
	Grand total	2.8 Lakh	40000/Rs	2.0 Lakh	5.2 Lakhs

16.1. Justification for the manpower requirement: To do Process optimization man power is required

16.2. Justification for consumables: Chemicals are the consumables

16.3. Justification for Equipment: equipments are the primary requirement without Rota vapor, oil bath and magnetic stirrer project won't proceed in single step synthesis

16.4. Justification for other costs: In vitro and in vivo studies and Patenting process cost

17. Scientific Impact, dissemination and potential exploitation:

Molnupiravir is the world fist anti – Covid – 19 drug, Indian pharmaceutical company official said in a Times of India a few weeks back that molnupiravir has shown promise in the treatment of mild to moderate Covid – 19 in adults, having nearly halved the risk of hospitalisation and death. Several companies including Natco, Dr. Reddy's, Cipla, Sun Pharma, Hetero and BDR Pharma are awaiting the regulatory nod to introduce the generic antiviral in India, which is expected to be at affordable price. The development assumes significance because the antiviral oral pill, developed by the Merck and its partner Ridgeback, is touted as a game changer for high – risk individuals and people with weakened immunity, cutting the risk of hospitalisation. Recently, the UK medicines and Healthcare Products Regulatory Agency granted a conditional approval to the drug

18. References:

(1) Stuyver, L. J.; Whitaker, T.; McBrayer, T. R.; HernandezSantiago, B. I.; Lostia, S.; Tharnish, P. M.; Ramesh, M.; Chu, C. K.; Jordan, R.; Shi, J.; Rachakonda, S.; Watanabe, K. A.; Otto, M. J.; Schinazi, R. F. Ribonucleoside Analogue That Blocks Replication of Bovine Viral Diarrhea and Hepatitis C Viruses in Culture. Antimicrob. Agents Chemother. 2003, 47, 244–254.

(2) Sheahan, T. P.; Sims, A. C.; Zhou, S.; Graham, R. L.; Pruijssers, A. J.; Agostini, M. L.; Leist, S. R.; Schäfer, A.; Dinnon, K. H., III; Stevens, L. J.; Chappell, J. D.; Lu, X.; Hughes, T. M.; George, A. S.; Hill, C. S.; Montgomery, S. A.; Brown, A. J.; Bluemling, G. R.; Natchus, M. G.; Saindane, M.; Kolykhalov, A. A.; Painter, G.; Harcourt, J.; Tamin, A.; Thornburg, N. J.; Swanstrom, R.; Denison, M. R.; Baric, R. S. An Orally Bioavailable Broad-spectrum Antiviral Inhibits SARS-CoV-2 in Human Airway Epithelial Cell Cultures and Multiple Coronaviruses in Mice. Sci. Transl. Med. 2020, 12, eabb5883

(3) Agostini, M. L.; Pruijssers, A. J.; Chappell, J. D.; Gribble, J.; Lu, X.; Andres, E. L.; Bluemling, G. R.; Lockwood, M. A.; Sheahan, T. P.; Sims, A. C.; Natchus, M. G.; Saindane, M.; Kolykhalov, A. A.; Painter, G. R.; Baric, R. S.; Denison, M. R. Small-Molecule Antiviral β-D-N4 - Hydroxycytidine Inhibits a Proofreading-Intact Coronavirus with a High Genetic Barrier to Resistance. J. Virol. 2019, 93, e01348-19.

(4) Urakova, N.; Kuznetsova, V.; Crossman, D. K.; Sokratian, A.; Guthrie, D. B.; Kolykhalov, A. A.; Lockwood, M. A.; Natchus, M. G.; Crowley, M. R.; Painter, G. R.; Frolova, E. I.; Frolov, I. β-D-N4 - Hydroxycytidine Is a Potent Anti-alphavirus Compound That Induces a High Level of Mutations in the Viral Genome. J. Virol. 2018, 92, e01965-17.

(5) Jena, N. R. Role of Different Tautomers on the Base-Pairing Abilities of Some of the Vital Antiviral Drugs used Against COVID-19. Phys. Chem. Chem. Phys. 2020, 22, 28115−28122.

(6) Cox, R. M.; Wolf, J. D.; Plemper, R. K. Therapeutically Administered Ribonucleoside Analogue MK-4482/EIDD-2801 Blocks SARS-CoV-2 Transmission in Ferrets. Nature Microbiol. 2021, 6, 11− 18.

(7) Merck and Ridgeback Bio Announce Closing of Collaboration and Licensing Transaction. Merck, July 1, 2020. https://www.merck.com/ news/merck-and-ridgeback-bio-announce-closing-of-collaboration and-licensing-transaction/ (accessed 2021-04-14).

(8) Efficacy and Safety of Molnupiravir (MK-4482) in Hospitalized Adult Participants with COVID-19 (MK-4482-001). https:// clinicaltrials.gov/ct2/show/NCT04575584 (accessed 2021-04-14).

(9) Ridgeback Biotherapeutics and Merck Announce Preliminary Findings from a Phase 2a Trial of Investigational COVID-19 Therapeutic Molnupiravir. Merck, March 6, 2021. https://www.merck.com/news/ ridgeback-biotherapeutics-and-merck-announce-preliminary-findings from-a-phase-2a-trial-of-investigational-covid-19-therapeutic molnupiravir/ (accessed 2021-04-14).

(10) Painter, G. R.; Bluemling, G. R.; Natchus, M. G.; Guthrie, D. N4-Hydroxycytidine and Derivatives and Anti-viral Uses Related Thereto. WO 2019113462, June 13, 2019.

(11) Steiner, A.; Znidar, D.; Ö tvös, S. B.; Snead, D. R.; Dallinger, D.; Kappe, C. O. A High-Yielding Synthesis of EIDD-2801 from Uridine. Eur. Eur. J. Org. Chem. 2020, 2020, 6736−6739.

(12) Miah, A.; Reese, C. B.; Song, Q. Convenient Intermediates for the Preparation of C-4 Modified Derivatives of Pyrimidine Nucleosides. Nucleosides Nucleotides 1997, 16, 53–65.
(13) Gopalsamuthiram, V.; Williams, C.; Noble, J.; Jamison, T. F.; Gupton, B. F.; Snead, D. R. A Concise Route to MK-4482 (EIDD2801) from Cytidine: Part 2. Synlett 2021, 32, 326–328.
(44) Vasudevan, N.; Ahlqvist, G. P.; McGeough, C. P.; Paymode, D. J.; Cardoso, F. S. P.; Lucas, T.; Dietz, J.-P.; Opatz, T.; Jamison, T. F.; Gupton, B. F.; Snead, D. Chem. Commun. 2020, 56, 13363–13364.
(14) (a) Ahlqvist, G. P.; McGeough, C. P.; Senanayake, C.; Armstrong, J. D.; Yadaw, A.; Roy, S.; Ahmad, S.; Snead, D. R.; Jamison, T. F. Progress Towards a Large-Scale Synthesis of Molnupiravir (MK-4482, EIDD-2801) from Cytidine. ChemRxiv 2021. DOI: 10.26434/chemrxiv.13809527.v1. (b) Paymode, D. J.; Vasudevan, N.; Ahmad, S.; Kadam, A. L.; Cardoso, F. S. P.; Burns, J.; Cook, D. W.; Stringham, R. W.; Snead, D. R. Toward a Practical, TwoStep Process for Molnupiravir from Cytidine. ChemRxiv 2021, DOI: 10.26434/chemrxiv.13550537.v1.
(15) Hu, T.; Xie, Y.; Liu, Y.; Xue, H.; Zhu, F.; Aisa, H. A.; Shen, J. A Convenient and Cost Efficient Route Suitable for "One-Pot" Synthesis of Molnupiravir. ChemRxiv 2021, DOI: 10.26434/chemrxiv.14208206.v1
(16)Dinesh J. Paymode, N. Vasudevan, Saeed Ahmad, Appasaheb L. Kadam, Flavio S.P. Cardoso, Justina M. Burns, Daniel W. Cook, Rodger W. Stringham, and David R. Snead: Toward a Practical, Two-Step Process for Molnupiravir: Direct Hydroxamination of Cytidine Followed by Selective Esterification: Org. Proces. Proce. Inter. https://doi.org/10.1021/acs.oprd.1c00033
(17) Raghunath Dey, Sourav Nayak, Parthasarathi Das and Somanath Yadav: Short Synthesis of Molnupiravir (EIDD-2801) via a Thionated Uridine Intermediate: ACS Omega https://doi.org/10.1021/acsomega.1c04550

19. Appendices (copy of questionnaire, consent forms, etc.)

*Note 1: ***All proposals are subject to initial screening. If a proposal passes initial screening it is formally accepted as an application and will enter a second screening stage comprising of a high powered committee.***

*Note 2: Submit the completed form (both hard and soft copy) to the Principal, Kcas

Endorsement from the Head of Department*
(To be given on letter head)

Project Title: Synthesis of analogues of Molnupiravir and their Anti – Covid - 19 activity

1. Certified that the Department welcomes participation of **Dr. Hareesh Kumar P** as the Principal Investigator and **Mr. S G Prasanna Kumar** as the Principal Co-Investigator for the Project and that in the unforeseen event of discontinuance by the Principal Investigator, the Principal Co-Investigator will assume the responsibility of the fruitful completion of the Project.

Date: 30th November 2021
Place: Bengaluru

Name and Signature of Head of Department

S. G. Prasanna Kumar
(Prasanna Kumar S.G.)

Certificate from the Investigator

Project Title: Synthesis of analogues of Molnupiravir and their Anti – Covid - 19 activity

1. I/ We agree to abide by the terms and conditions of the research grant.
2. I/ We did not submit the Project proposal elsewhere for financial support.
3. I/ We have explored and ensured that equipment and basic facilities will actually be available as and when required for the purpose of the Projects.
4. I/ We undertake that on permanent equipment will be made available to other users during spare time.

Date: 30th November 2021
Place: Bengaluru

Dr. Hageeshkumar P. 30/11/21
Name and signature of Principal Investigator

Date: 30th November 2021
Place: Bengaluru

Name and signature of Co- Investigator
(Prashanth Kumar S.)

The above project is Approved / Not Approved
Comments:

Signatures of the committee Members
1.

2.

3.

Signature of the Principal

RAMAIAH
College of Arts, Science & Commerce

ಎಮ್ ಎಸ್ ರಾಮಯ್ಯ ಕಲಾ, ವಿಜ್ಞಾನ ಮತ್ತು ವಾಣಿಜ್ಯ ಕಾಲೇಜು
M S Ramaiah College of Arts, Science and Commerce
Re-accredited 'A' by NAAC, Permanently Affiliated to Bengaluru City University,
Approved by Government of Karnataka, Approved by AICTE, New Delhi,
Recognized by UGC under 2f & 12B of UGC act 1956

Date: 14.02.2022

To,
Dr. B. M. Nagabhushana
Professor and Head
Dept of Chemsitry
MSRIT
Bengaluru

Dear Sir,

Subject: Request to scrutinize the Research Proposal for Seed Money grant.

With reference to the above subject, the research proposal for Seed Money grant has been received from our faculty members (4 Nos).

I request you to kindly scrutinize the proposals and provide a convenient date and time for the presentation.

Thanking you

Regards

Dr. A. Nagarathna
Principal,
M.S. Ramaiah College of Arts, Science & Commerce
MSRIT Post, MSR Nagar
Bangalore - 560 054

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RAMAIAH
College of Arts, Science
& Commerce

Research and Development Fund
Format for submitting the Research Proposal

Name of the Principal Investigator	Mr. Bharath K. Devendra.
Qualification	M.Sc., (Ph.D.) Thesis submitted.
Affiliation	M.S. Ramaiah College of Arts, Science and Commerce.
Department	Chemistry/Biochemistry
Address , Phone Number and e-mail	Department of Chemistry, M.S. Ramaiah College of Arts, Science and Commerce, MSR Nagar, MSRIT Post, Bengaluru-54 Mob:9900334993 Email ID:bharathkdevendra@gmail.com
Papers Published in the research area (Attach brief profile)	Electrodeposition, Corrosion Science, Hydrogen Generation and Photocatalyst.

Name of the Co-investigator	Dr. R Hari Krishna
Qualification	M.Sc, Ph.D.,
Department	Chemistry
Affiliation	M.S. Ramaiah Institute of Technology
Address , Phone Number and e-mail	Department of Chemistry, M.S. Ramaiah Institute of Technology, MSR Nagar, MSRIT Post, Bengaluru-54 Mob:9886434109 Email ID:rhk.chem@msrit.edu
Papers Published in the research area (Attach brief profile)	Nanomaterials, Materials Chemistry and Luminescence Spectroscopy.

1. Title of the Proposal: **"Advanced Strategies for Hydrogen Generation and Photocatalyst Applications using Noble Metal Catalysts"**

2. Broad Area of Research: **Photocatalyst and Hydrogen Generation.**

3. Sub Area of Research: **Corrosion Science.**

4. **Brief Introduction:** More than 150 years earlier, Elkington, who received a patent in 1837 [1]and later Bijttger, developed the first experiments on the electrolytic deposition of platinum group metals[2]. Platinum, palladium, rhodium, ruthenium, iridium, and osmium are members of the platinum group metals (PGM). Only platinum, palladium, and rhodium have previously found significant use in the electrodeposited condition [3]. The main disadvantage of

this alloy coating is its high cost; however, its benefits include excellent chemical and oxidation resistance, as well as high strength, the main resistance to corrosion at high temperatures, are present in different areas such as the production of glass [4] and nitrogen fertilizers [5,6], thermocouples [7],automotive catalysts [9], jewellery [9,10] etc. Despite being one of the fastest electrocatalytic reactions, the hydrogen evolution reaction (HER) requires high noble metal loadings (0.5–1.0 mg/cm^2). It requires optimization of the extent of catalyst loading in order to reduce the cost of the electrode. Redox reactions at electrode and solution interfaces are becoming increasingly important in modern science and technology, as they decide the efficiency of a variety of electrochemical devices to be used in the future for sustainable renewable energy (11-15). Efficiencies of electrolysers and fuel cells are mainly determined by the effectiveness of interface between catalytic electrodes and electrolytes (16-21). However by using latest technology and art, only around 4% of hydrogen is produced from water electrolysis (22-24). It is mainly due to lack of design of the electrodes that leads to less production of hydrogen with high over voltage leading to high energy loss. In producing 15 trillion moles of hydrogen per year (4%), the average price is EUR 0.1kWh in the US and Europe (25-27). These costs of production are higher than that for production of hydrogen using noble metal as catalysts. By using the proper knowledge in noble metal coating, production of hydrogen is economically viable method (28-29). The amount of noble metals on the coating is very important parameter and by using proper knowledge small amount noble metals in the coating reduces the cost effect and gives the highest amount of hydrogen gas. The electrochemical method for dye pollution treatment has recently received a lot of attention, owing to its ease of automation, high sustainability, and environmental friendliness [30-31].The traditional methods were inadequate to purify the wastewater, simply moving the compounds from aqueous to another phase, causing secondary pollutants [32].Photocatalysis in presence of Noble metal like platinum is considered as the best method for effluent treatment. Effluents can be converted into potable water with platinum as a catalyst is a simple and effective method. Pulse Electrodeposition is considered a more efficient method of Electroplating compare to the DC method of Electrodeposition. In the PC method, based on the required current can be controlled by the ON and OFF method. In ON time current is passed into the time it is switched off. During OFF time more time will be given to nucleation and which reduces the nuclei size and give the uniform crystalline size

5. Background and statement of the problem (this in the light of a thorough National and International literature review):

Dyes are extensively used in textiles, paper, rubber, plastics, leather, cosmetics, pharmaceuticals and food industries resulting in a steady growth of demand and production. Today there are more than 10,000 synthetic dyes available commercially and more than 7×105 tonnes are produced annually (Torres et al. 2010; Joo et al. 2007). Synthetic dyes usually have a complex aromatic molecular structure which possibly comes from coal tar based hydrocarbons such as benzene, naphthalene, anthracene, toluene, xylene, etc. (Mishra &Tripathy 1993). From an environmental point of view, the disposal of synthetic dyes is of great concern (Golob et al. 2005).

The discharge of dye-bearing wastewater into natural streams and rivers from industries create severe problems. One of the most serious environmental problems of the present day is the cleaning of wastewater. The colour of wastewater prevents re-oxygenation by cutting off penetration of sunlight. It also increases the BOD and cause lack of dissolved oxygen. In addition, most of the dyes even in very low concentration are toxic to some microorganisms and also to aquatic life and cause direct destruction or inhibition of their catalytic capabilities. Many dyes are difficult to degrade as they are resistant to aerobic digestion. Dyes can also cause allergic dermatitis and skin irritation. Some of them have been reported to be carcinogenic and mutagenic. Hence a contamination due to dyes is not only a severe public health concern but also may cause serious environmental problems because of their persistence. This upsets the biological activities in water bodies.

According to the National Association of Corrosion Engineers International India section (NACE), the annual direct loss cost of corrosion may be 4% of the Gross Domestic Product (GDP), which is estimated to be around Rs.350 billion dollars per year. In this connection, the solution to reduce this phenomenal loss is to ensure that industries take up corrosion prevention as an important issue even at the design state. It is apparent that a person working in the field of corrosion is responsible not only for the protection of the products, equipment and welfare of the individuals but also for providing this at reasonable cost

The extensive consumption of fossil fuels over the past century has led to serious concerns like global warming, ozone layer depletion and acid rain. A long term energy supply solution that is practical, low cost, and clean is required. Renewable energy sources such as solar, wind currently cannot be used directly as fuel and require a storage medium because of their intermittent nature. Among the many choices, hydrogen has been identified as a potential energy carrier that can be stored, transported and distributed. Hydrogen is the most abundant element on earth and is considered as a leading candidate as energy carrier. However, elemental hydrogen is not available in substantial quantity on earth and is found in combination with carbon in hydrocarbons and with oxygen in water. Hydrogen is not a source of energy, but only a carrier of energy and requires technology to be produced (Barbir 2005a). Hydrogen generated on-site using a variety of

technologies could lead to development of decentralized micro power plants and vehicles basedon hydrogen (fuel cells, internal combustion engine utilizing hydrogen) would dramatically reduce emissions of particulates, carbon monoxide, sulphur and nitrogen oxides and other local pollutants as the only by product of combustion is water (Dunn 2002). A well-established method of deriving hydrogen is electrolysis, which involves the use of electricity to split water into hydrogen and oxygen atoms. At present, roughly 4 % of the world's hydrogen is derived from the electrolysis of water (Committee on). This process produces extremely pure hydrogen in small amounts.

Research question or hypothesis, aim and objectives:

Optimization of noble metal bath solution and desired coating by electrodeposition method. Studying the growth nucleation mechanism of the selected noble metals and characterization of the samples. Desired coated samples are subjected to the corrosion studies, electrocatalytic hydrogen generation and dye degradation by photocatalyst.

6. Research design (type of study):

a) Purchase of equipment and chemicals.

a) Setting up of experiment.

b) Optimization of bath constituents.

c) Preparation of representative oxide layers on the surfaces of structural materials, such as SS304/SS316.

d) Noble metal electrodeposition on steel surface.

e) Optimization of electroplating process for getting the desired coating.

f) Cyclic voltammetry and chronoamperometry study for understanding the mechanism of electrodeposition.

g) Surface morphology analysis by SEM, AFM, and XRD.

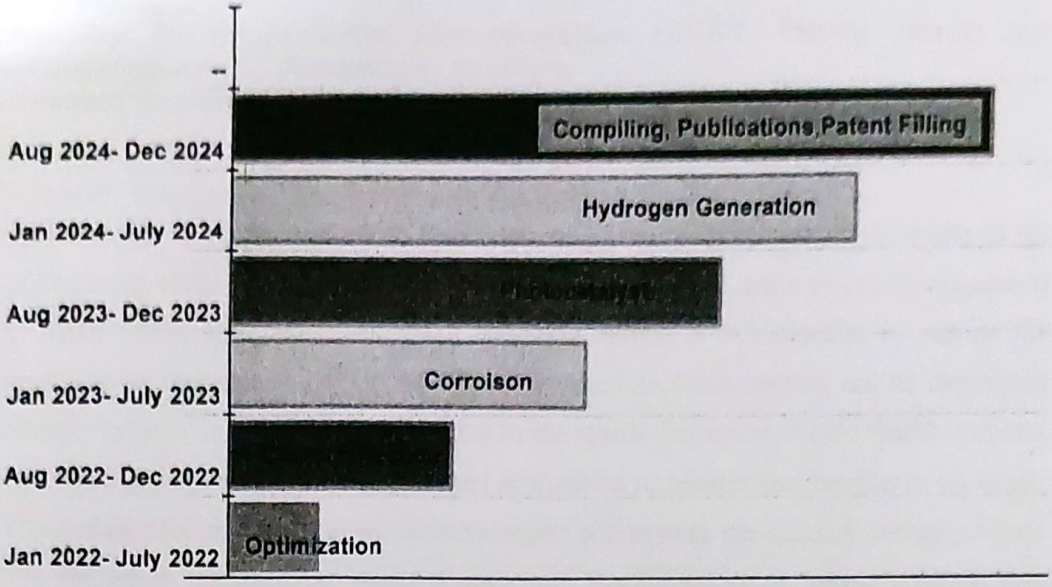
h) Evaluation of corrosion behaviour and applications towards hydrogen generation and dye degradation by photocatalyst technique.

i) Compiling of all the results.

j) Patent filling and Publishing the results in reputed journals.

7. Study population and sampling (If applicable) : **N/A**
8. Data collection methods and instruments: **N/A**
9. Data analysis methods – if applicable statistical planning must be fully addressed, or the candidate should provide evidence that statistics are not required
10. Mechanisms to assure the quality of the study: **N/A**

11. Research Schedule -Bar chart for completion of the project:



12. Participants in the study – all people involved in the study, and the role they play, should be identified.*:

PI role: Involvement in conceptualization, methodology, visualization, investigation, software, data curation and writing-original draft.

Co-PI Role:Involvementin methodology, formal analysis, resources, project administration, data curation, investigation and article writing.

13. Ethical considerations:

In our study, no peoples or animals were required in a way that is harmful to society.

14. Environmental Issues:

Chemical disposal measures will be fallowed as per the Institution rules and regulations and Environmental Protection Agency's safety standard.

15. Resources required for the study, including budget (Personnel, Consumables, Equipment, Travel, Subcontracting, Provisions, Licensing fees, other)……

Sl. No	Item	BUDGET			Amount (In Rupees)
and		1st Year	2nd Year	3rd Year	Total
1.	Equipment	3,00,000	----	----	3,00,000
2.	Consumables	1,00,000	50,000	25,000	1,75,000
3.	Research Assistant	N/A	N/A	N/A	N/A
4.	Travel	5,000	----	----	5,000
5.	Other costs	15,000	15,000	10,000	40,000
	Grand total	**4,20,000**	**65,000**	**35,000**	**5,20,000**

15.1. Justification for the manpower requirement: **N/A**

15.2. Justification for consumable: **Noble metals, dyes, reagents, etc. all this will be used as chemicals. Also anode and working electrode like SS/MS (Stainless Steel/Mild Steel) during plating.**

15.3. Justification for Equipment:**For Electrodeposition (DC/PC Plating source) and Spectrophotometer for Photocatalyst technique.**

15.4. Justification for other costs:**Characterization of samples and Contingencies**.

16. Scientific Impact, dissemination and potential exploitation:

This invention involves the field of electrodeposition of metals. More precisely, it relates to the process of obtaining noble metal coating by both DC and PC methods and it can be distinguished by SEM, XRD, EDX, XPS etc. Conclusion evidence favors in PC samples to reduce the crystalline size more compare to the DC samples and results in finest coating can be developed for the PC duty cycle. For dyes, which is present in the textile industries, Noble metals exhibits higher photodegradation and has a great potential application in wastewater treatment. All in all, one day electrodeposited metal and alloy-coated samples will replace the existing methods which are suitable for waste management, water disinfection. Developed noble metals coatings can show same trend similar to that of pure platinum towards HER.These coatings are economical and maybe used for commercial applications in production of hydrogen. Contribution of noble metals towards corrosion mitigation is highly noticeable by the researchers [33-35].

18. **References**:

1.E. Laister, Metal Ind., 1954;85:427-469.

2. E. Preston, Platinum in the glass industry. Platinum Met. Rev., 1960;4:48-55.

3. B. Fischer, Reduction of platinum corrosion in molten glass. Platinum Metals Rev., 1992;36:14-25.

4. Y. Ning, Z. Yang, H.Zhao, Platinum recovery by palladium alloy catchment gauzes in nitric acid plants. Platinum Met. Rev., 1996;4:80-87.

5.N. Yuantao, Y. Zhengfen, .Platinum loss from alloy catalyst gauzes in nitric acid plants. Platinum Met. Rev., 1999;43:62-69.

6. B.Trumić, D. Stanković, V. Trujić, Examining the surfaces in used platinum catalysts. Journal of Mining and Metallurgy, 2009;45:79-87.

7. B. Wu, G. Liu, Platinum: Platinum-rhodium thermocouple wire. Platinum Met. Rev., 1997;41:81-85.

8.M. Funabikia, T.Yamadaa, K.Kayanoa, Auto exhaust catalysts.Catal. Today, 1991;10:33-43.

9.T. Biggs, S.Taylor, E. Van der Lingen, The hardening of platinum alloys for potential jewellery application. Platinum Met. Rev., 2005;49:2-15.

10.J. Wright, Jewellery-related properties of platinum: Low thermal diffusivity permits use of laser welding for jewellery manufacture. Platinum Metals Rev., 2002;46:66-72.

11. Norskov J, Bligaard K, Rossmeisl T, Christensen C.H (2009) Towards the computational design of solid catalysts. Nat. Chem.**1**:37–46.

12. M.T.M. Koper (2011)Structure sensitivity and nanoscale effects in electrocatalysis .Nanoscale. 3:2054–2073.https://doi.org/10.1039/C0NR00857E
13. StephensIfan E.L, BondarenkoAlexnader S, Gronbjerg U, Rossmeisl J, Chorkendorff I (2012)Understanding the electrocatalysis of oxygen reduction on platinum and its alloys. Energy Environ. Sci.**5**:6744–6762. https://doi.org/10.1039/C2EE03590A
14.Mokhtar M, Ohlinger O, Schlander H, Turek T (2001)Hydrogenolysis of dimethyl maleate on $Cu/ZnO/Al_2O_3$catalysts.Chemical Engineering & Technology. 24. https://doi.org/10.1002/1521-4125(200104)24:4<423::AID-CEAT423>3.0.CO;2-G
15. JeongEun Y, Abdulohsen Ali A, Shanshan Q, Salem Mohamed B, Mohamed Mokhtar M.M, Narasimharao K, Dominik F, Jochen S, nca M, Nikita D, Gihoon G, Karsten M, Patrik S (2020) Establishing High Photocatalytic H_2 Evolution from MultiwalledTitanate Nanotubes.ChemCatChem.12:2951-2956. https://doi.org/10.1002/cctc.202000281
16. Symes Mark D, Cronin L (2013) Decoupling hydrogen and oxygen evolution during electrolytic water splitting using an electron-coupled-proton buffer. Nat. Chem.**5**, 403–409. https://doi.10.1038/NCHEM.1621
17. AliaksandrBandarenka S, Marc.T.M. Koper (2013) Structural and electronic effects in heterogeneous electrocatalysis: Toward a rational design of electrocatalysts. J. Catal.308:11–24.https://doi.org/10.1016/j.jcat.2013.05.006
18. Holewinski A, Xin H, Nikolla E, Linic S (2013) Identifying optimal active sites for heterogeneous catalysis by metal alloys based on molecular descriptors and electronic structure engineering. Current opinion in Chem. Eng. **2**:312–319. https://doi.org/10.1016/j.coche.2013.04.006
19.Jakub T, Federico Calle-Vallejo, Wolfgang S, AliaksandrBandarenka S(2016)Making the hydrogen evolution reaction in polymer electrolyte membrane electrolysers even faster.Nature communications. https://doi.org/10.1038/ncomms10990
20. Mohsen S, Seyedsina H, Shiva M, Ondrej T, Mohamed Mokhtar, Abdulmohsen A, Sohrab S, Radek Z, Patrik S (2019) Photocatalytic H_2 Evolution: Dealloying as Efficient Toolfor the Fabrication of Rh-decorated TiO_2 Nanotubes.ChemCatChem.**11**:6258-6262. https://doi.org/10.1002/cctc.201901183

21. JeongEun Y, Marco A, Mohamed M, Abdulmohsen A.A, Al-Thabaiti S.A, Anca M, PatrikSchmuki (2016) Photocatalytic H_2 Generation Using Dewetted Pt-Decorated TiO_2 Nanotubes: Optimized Dewetting and Oxide Crystallization by a Multiple Annealing Process. The Journal of Physical chemistry C. **120**. DOI: 10.1021/acs.jpcc.5b12050
22. NagiRadwan R.E, Mokhtar M, El-Shobaky G.A (2003) Surface and catalytic properties of CuO and Co_3O_4 solids as influenced by treatment with Co^{2+} and Cu^{2+} species. Applied Catalysis A: General. **241**:77-90.DOI:10.1016/S0926-860X(02)00459-3

23. Bicakova O, Straka P (2012) Production of hydrogen from renewable resources and its effectiveness. International Journal of Hydrogen Energy.**37**:11563–11578.DOI: 10.1016/j.ijhydene.2012.05.047
24. Ahmed N. S,__ Menzel R, _Wang Y, Garcia- G.A,Bawaked S.M, Obaid A.Y, Basahel S.N, Mokhtar M (2017) Graphene-oxide-supported CuAl and CoAl layered double hydroxides as enhanced catalysts for carbon-carbon coupling via Ullmann reaction. Journal of Solid State Chemistry.**246**:130-137. https://doi.org/10.1016/J.JSSC.2016.11.024

25. El-Shobaky G.A, Ahmad A.S, Mokhtar M (1997) Effect of gamma-irradiation on surface and catalytic properties of $CuO-ZnO/Al_2O_3$ system. Journal of radioanalytical and nuclear chemistry.**219**:89-94.Doi: 10.1007/bf02040271

26. Carmo M, David. Fritz L, Mergel J, Stolten D (2013) A comprehensive review on PEM water electrolysis. International Journal of Hydrogen Energy.**38**:4901–4934. https://doi.org/10.1016/j.ijhydene.2013.01.151

27. Subbaraman, R. Dusan T, Dusan S, Kee-Chul C, Masanobu U, Arvydas P, Vojislav S, Nenad M(2011) Enhancing hydrogen evolution activity in water splitting by tailoring Li+-Ni(OH)$_2$-Pt interfaces. Science. **334**:1256–1260. https://doi: 10.1126/science.1211934

28. Yin, H. J. Shenlong Z, Kun Z, Abdul M, Hongjie T, Lin C, Huijun Z, Yan G, Zhiyong T. (2015) Ultrathin platinum nanowires grown on single-layered nickel hydroxide with high hydrogen evolution activity. Nat. Commun. **6**:6430. https://doi: 10.1038/ncomms7430.

29. Yang, X. F. Aiqin W, Botao Q, Jun L, Jingyue L, Tao Z(2013) Single-atom catalysts: a new frontier in heterogeneous catalysis. Acc. Chem. Res. **46**:1740–1748.

30. E. Chatzisymeon, A. Dimou, D. Mantzavinos, A. Katsaounis (2009) J. Hazard. Mater.,167:268 274.

31. S. Fierro, C. Comninellis (2010) Kinetic study of formic acid oxidation on Ti/IrO2 electrodes prepared using the spin coating deposition technique. Electrochimica. Acta 55:7067–7073 .https://doi.org/10.1016/j.electacta.2010.06.066

32. I. D. Santos, M. Dezotti, A.J.B. Dutra (2013) Electrochemical treatment of effluents from petroleum industry using a Ti/RuO2 anode.Chem. Eng. J., 226:293–299. https://doi.org/10.1016/j.cej.2013.04.080

33. B.K. Devendra, B.M. Praveen, V.S. Tripathi, D.H. Nagaraju, K.O. Nayana, Hydrogen Evolution Reaction by Platinum Coating. Iranian Journal of Science and Technology, Transactions A: Science, 45, 1993-2000 (2021). https://doi.org/10.1007/s40995-021-01220-2

34. B.K. Devendra, B.M. Praveen, V.S. Tripathi, D.H. Nagaraju and K.O. Nayana. Pt-Rh Alloy Catalysts for Hydrogen Generation developed by Direct Current/Pulse Method. Journal of Iranian Chemical Society, 1-10 (2021). https://doi.org/10.1007/s13738-021-02433-3

35. B.K. Devendra, B.M. Praveen, V.S. Tripathi, G. Nagaraju, D.H. Nagaraju, K.O. Nayana. Highly Corrosion Resistant Platinum-Rhodium alloy coating and its photocatalytic activity. Inorganic Chemistry Communications, 109065. https://doi.org/10.1016/j.inoche.2021.10906

19. Appendices (copy of questionnaire, consent forms, etc.)

*Note 1:***_All proposals are subject to initial screening. If a proposal passes initial screening it is formally accepted as an application and will enter a second screening stage comprising of a high powered committee._**

*Note 2:Submit the completed form(both hard and soft copy) to the Principal, RCASC

Endorsement from the Head of Department*
(To be given on letter head)

1. **Project Title: "Advanced Strategies for Hydrogen Generation and Photocatalyst Applications using Noble Metal Catalysts"**

Certified that the Department welcomes participation of Mr **Bharath K. Devendra** as the Principal Investigator and **Dr. R. Hari Krishna** as the Principal Co-Investigator for the Project and that in the unforeseen event of discontinuance by the Principal Investigator, the Principal Co-Investigator will assume the responsibility of the fruitful completion of the Project.

Date: 30/11/2024

Place: Bengaluru.

S. G. Prasanna Kumar

Prasanna Kumar. S.G.

Name and Signature of Head of Department

Head of the Department
CHEMISTRY / BIO-CHEMISTRY
M.S. Ramaiah College of Arts,
Science & Commerce
Bangalore - 560 054

Certificate from the Investigator

Project Title:

1. I/ We agree to abide by the terms and conditions of the research grant.

2. I/ We did not submit the Project proposal elsewhere for financial support.
3. I/ We have explored and ensured that equipment and basic facilities will actually be available as and when required for the purpose of the Projects.
4. I/ We undertake that on permanent equipment will be made available to other users during spare time.

Date: 30/11/2024
Place: Bengaluru

Bharath K. Devendra.
Name and signature of PrincipalInvestigator

Date: 30/11/2024
Place: Bangalore

Dr. R.Hari Krishna
Name and signature of Co- Investigator

The above project is Approved / Not Approved

Comments:

Signatures of the committee Members

1.

2.

3.

Signature of the Principal

RAMAIAH
College of Arts, Science
& Commerce

DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY
Research Proposal

Name of the Principal Investigator	Dr. Hareesh Kumar P
Qualification	M Sc., Ph. D.,
Affiliation	M S Ramaiah College of Arts, Science and Commerce
Department	Chemistry/ Biochemistry
Address , Phone Number and e-mail	MSRIT Post, MSR Nagara, Mathikere, Bengaluru – 560054, 9663572041 hareesh.kp6@gmail.com
Papers Published in the research area(Attach brief profile)	Medicinal Chemistry, Organic Synthesis, Natural Product, Process development, Nano composites, Metallomesogens. I am having quite a substantial experience in synthesis and characterization of organic compounds during my Industrial and Research experience, for that I got eight publication out of which one is Indian patent and other one is book which is published in Lambert academic press, Germany very recently and all my publications are related to organic synthesis.

Name of the Co-investigator	Mr. S G Prasanna Kumar
Qualification	M Sc.MPhil, D. Pharma (PhD)
Department	Chemistry/ Biochemistry
Affiliation	M S Ramaiah College of Arts, Science and Commerce
Address , Phone Number and e-mail	MSRIT Post, MSR Nagara, Mathikere, Bengaluru – 560054 8197132950 prasanna_chem@msrcasc.edu.in
Papers Published in the research area (Attach brief profile)	Material science, Nanomaterials, Organic Synthesis:

1. Title of the Proposal: **Synthesis of analogues of Molnupiravir and their Anti Covid - 19 activity**
2. add Area of Research Organic Synthesis, Medicinal and Process chemistry, Nano composites, Metallomesogens
3. Sub Area of Research: Organic Chemistry
4. Brief Introduction:

World's first medicine to treat symptomatic Covid – 19 is Molnupiravir (1, EIDD-2801, MK-4482) is an orally active antiviral prodrug candidate that was discovered at Emory University. The active metabolite, β-D-N4 -hydroxycytidine (NHC, 2A/2B), was originally targeted for the treatment of hepatitis C (HCV) in the early 2000s.31 Molnupiravir has shown broad-spectrum activity against several RNA viruses, including influenza A and B, Ebola, norovirus, RSV, HCV, coronavirus, and Venzuelan equine encephalitis virus (VEEV). With the emergence of SARS CoV-2 in early 2020, focus rapidly shifted to the evaluation of molnupiravir for the treatment of SARS CoV-2.β-D-N4 -Hydroxycytidine acts by disrupting RNA synthesis. Incorporation of the molecule during viral RNA synthesis leads to subsequent base-pair misreading, resulting in high mutation rates and ultimately genome lethality. NHC exists as two tautomeric forms that have been shown to have similar energies in aqueous solution. A theoretical study suggested that the oxime tautomer 37B may base-pair with uracil (U), adenine (A), and guanine (G) while the hydroxylamine tautomer 37A mimics cytosine (C), which base-pairs with G, resulting in an assortment of mutations.35 In a study that examined the effect of NHC on viral guide RNA synthesis in VEEV, 8.9 mutations per 10 000 nucleotides were identified in media containing NHC versus only 0.85 mutations per 10 000 nucleotides in the control medium, a >10-fold increase. The majority of the mutations were transition mutations, with 4-fold more U-to-C or C-to-U than A-to-G or G-to-A.34 Molnupiravir has also been shown to have potent activity against SARS CoV-2 that is resistant to remdesivir. Oral treatment of molnupiravir to mice and ferrets infected with COVID-19 was effective in reducing viral load in the upper respiratory tract and in blocking transmission of the virus to untreated contact animals. The rights to molnupiravir were acquired by Ridgeback Biotherapeutics, which is now partnering with Merck to advance clinical trials for the treatment of SARS CoV-2. In October 2020, Merck initiated a Phase 2/3 trial in hospitalized patients with doses of 200, 400, and 800 mg twice daily for 5 days. with a target enrollment of 1300 patients. In March 2021, Merck and Ridgeback announced preliminary results from a Phase 2a study in 207 patients. The results of the primary end point, a reduction in time to viral negativity, were not disclosed. A secondary end point showed a reduction in time to negativity of infectious virus in nasopharyngeal swabs in patients with SARSCoV-2 infection.

5. Background and statement of the problem:

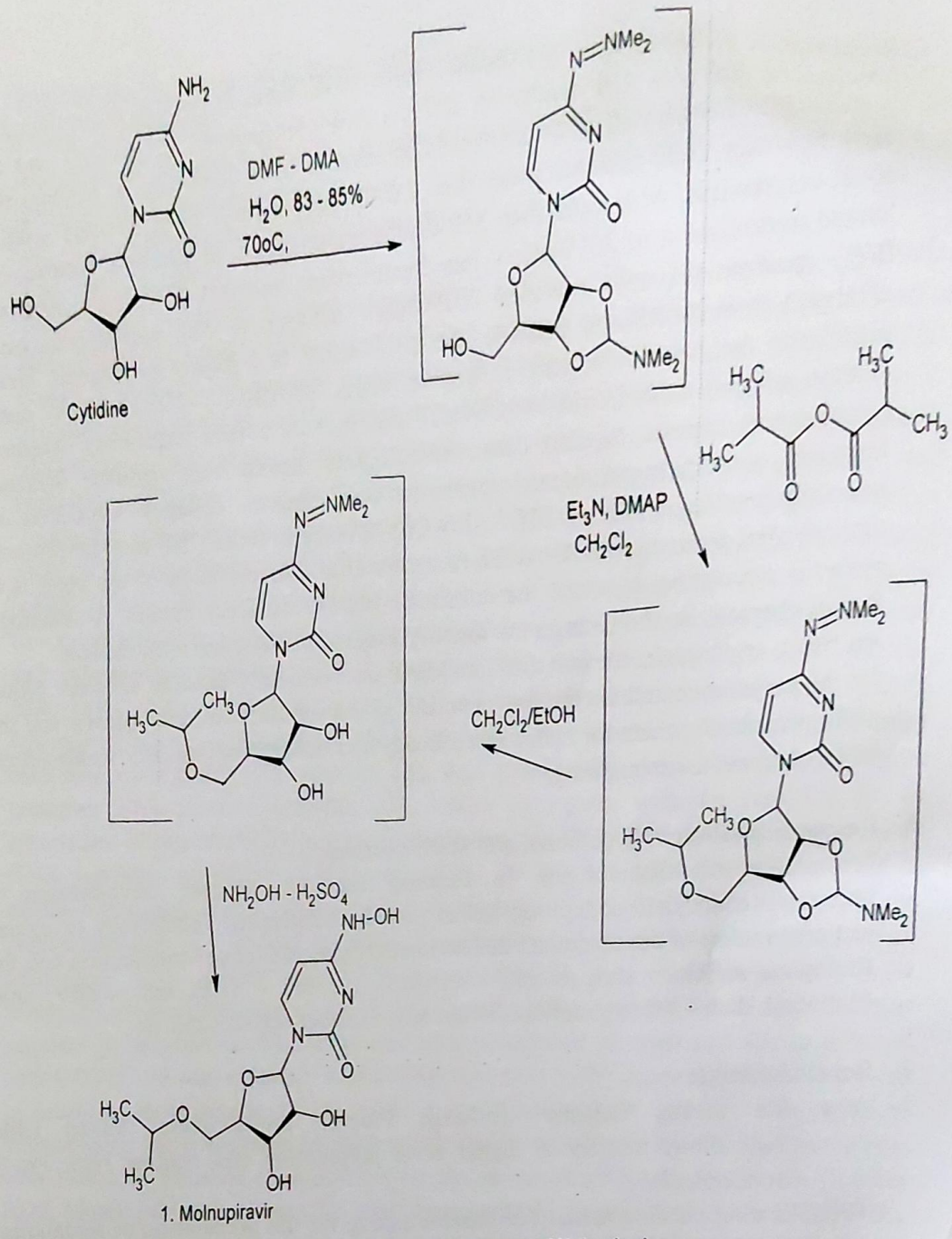
Coronaviruses are enveloped positive sense RNA viruses that cause a large percentage of respiratory illness in humans. The two previous coronaviruses to emerge and cause human illness were SARS and MERS, there were more than 8000

human cases of SARS with 774 deaths. Since 2012, there have been more than 2500 cases of MERS with 919 deaths, in 2019, a new coronavirus, 2019-nCoV and new known as SARS-CoV-2: was discovered in humans in Wuhan, China. Reports from early February 2020 indicate more than 28000 people have been infected with the novel coronavirus, with more than 560 deaths documented, in addition. Human – to-human transmission of 2019-nCoV has documented. Analysis of a single completed full – genome sequence revealed 2019-nCoV belongs to beta coronavirus but is divergent from SARS and MERS. The 2019-nCoV is a highly pathogenic human patghogen that relatively little is known about SARS-CoV-2/2019-nCoV causes disease referred to as Covid-19. Covid19 can include severe respiratory disease in humans and appears to also cause neurological disease that includes dizziness, impaired consciousness, acute cerebrovascular disease, epilepsy hyposmia and neuralgia (medRxiv, 2020, 1-26). SARS-CoV-2 entry into the CNS may be promoted through viral interaction with ACE2 receptors after dissemination of the virus in the systemic circulation or across the cribriform plate. Additional studies are needed to further characterize the virus and to identify ways to prevent and treat disease.
am being an Organic chemist, am looking at economically feasible efficient process for the preparation and Technology Transfer to manufacture of molnupiravir and their analogues development for better Bio efficacy and better economically viable product when compare to molnupiravir

6. Research question or hypothesis, aim and objectives:
   Preparation of molnupiravir in existing method, process development for improvement in yield and filling Indian patent, transferring Technology to industry and preparation of novel method development, novel analogues preparation and their Biological activities such as anti – Covid – 19, anti – viral, anti – HIV, anti – Microbial, Anti – Mycobacterial activity, anti – cancer activity and etc

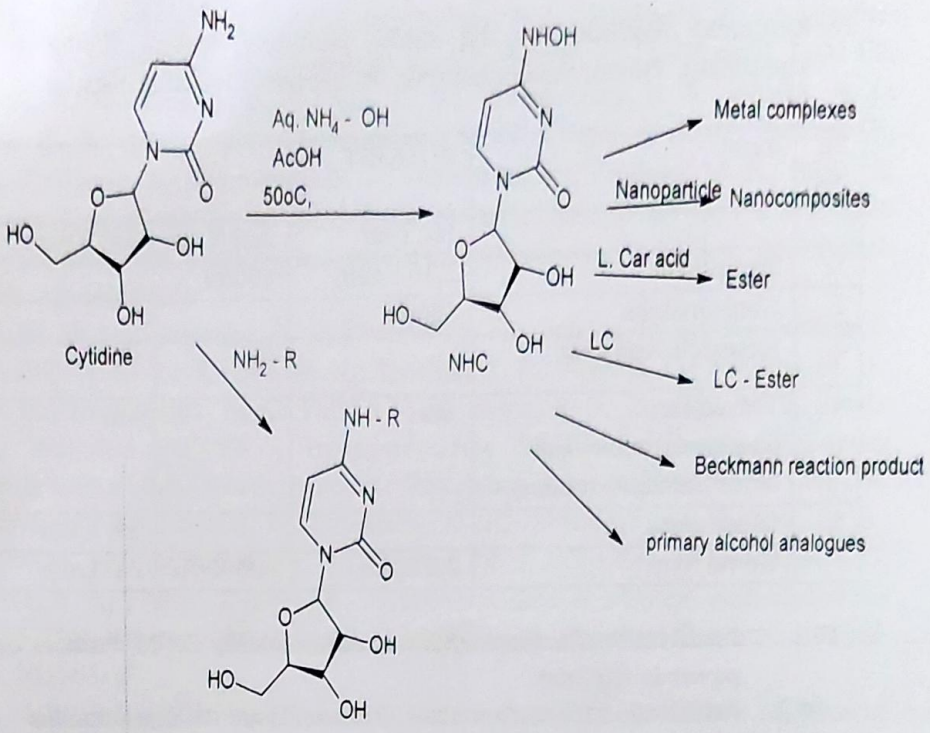
7. Research design:
   - It's mainly Organic synthesis, Process development, Patent filling, Technology transfer to higher scale preparation and making New Product development

   The following existing method of scheme taking for the preparation of molnupiravir and here looking for process development more particularly in yield improvement, once I got, then process will be optimized then can make process patent.



Scheme: for preparation & Process development of Molnupiravir

- Following methodology, would like to involve in making new chemical entity of molnupiravir analogues



Where R= NH_2, Semicarbozide, etc

Scheme: for preparation of anlogues of Molnupiravir

8. Study population and sampling (If applicable): NA
9. Data collection methods and instruments: IR, HRMS, H^1 NMR, C^{13}NMR, CHN analysis, XRD…etc.
10. Data analysis methods – if applicable statistical planning must be fully addressed, or the candidate should provide evidence that statistics are not required
11. Mechanisms to assure the quality of the study:
12. Research Schedule:
    - Procurement of chemical and glassware and instruments
    - Preparation of NHC or Molnupiravir
    - Process optimization of molnupiravir
    - Scale up of molnupiravir
    - Preparation of analogues of Molnupiravir their characterization, getting done of Biological activities- In vitro or in Vivo such as anti – Covid – 19 activity, anti – microbial, anti – bacterial, anti – HIV, anti – cancer etc.
    - Publications – We will Publish
13. Participants in the study – all people involved in the study, and the role they play, should be identified. *
14. Ethical considerations: Studies will be done in the Laboratories who are having the ethical clearance from concerned authorities
15. Environmental Issues: Disposal will be done as per slandered operating procedure,

16. Resources required for the study, including budget (Personnel, Consumables, Equipment, Travel, Subcontracting, Provisions, Licensing fees, other):

Sl. No	Item	BUDGET			Amount (In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	Equipment	2.30 Lakh	40000		
2.	Consumables	50000/			
3.	Research Assistant		01	01	
4.	Travel(for characterizations and other literature studies)	yes	yes	yes	2
5.	Other costs			2.0 Lakh	
	Grand total	2.8 Lakh	40000/Rs	2.0 Lakh	5.2 Lakhs

16.1. Justification for the manpower requirement: To do Process optimization man power is required

16.2. Justification for consumables: Chemicals are the consumables

16.3. Justification for Equipment: equipments are the primary requirement without Rota vapor, oil bath and magnetic stirrer project won't proceed in single step synthesis

16.4. Justification for other costs: In vitro and in vivo studies and Patenting process cost

17. Scientific Impact, dissemination and potential exploitation:

Molnupiravir is the world fist anti – Covid – 19 drug, Indian pharmaceutical company official said in a Times of India a few weeks back that molnupiravir has shown promise in the treatment of mild to moderate Covid – 19 in adults, having nearly halved the risk of hospitalisation and death. Several companies including Natco, Dr. Reddy's, Cipla, Sun Pharma, Hetero and BDR Pharma are awaiting the regulatory nod to introduce the generic antiviral in India, which is expected to be at affordable price. The development assumes significance because the antiviral oral pill, developed by the Merck and its partner Ridgeback, is touted as a game changer for high – risk individuals and people with weakened immunity, cutting the risk of hospitalisation. Recently, the UK medicines and Healthcare Products Regulatory Agency granted a conditional approval to the drug

18. References:

(1) Stuyver, L. J.; Whitaker, T.; McBrayer, T. R.; HernandezSantiago, B. I.; Lostia, S.; Tharnish, P. M.; Ramesh, M.; Chu, C. K.; Jordan, R.; Shi, J.; Rachakonda, S.; Watanabe, K. A.; Otto, M. J.; Schinazi, R. F. Ribonucleoside Analogue That Blocks Replication of Bovine Viral Diarrhea and Hepatitis C Viruses in Culture. Antimicrob. Agents Chemother. 2003, 47, 244–254.

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(2) Sheahan, T. P.; Sims, A. C.; Zhou, S.; Graham, R. L.; Pruijssers, A. J.; Agostini, M. L.; Leist, S. R.; Schäfer, A.; Dinnon, K. H., III; Stevens, L. J.; Chappell, J. D.; Lu, X.; Hughes, T. M.; George, A. S.; Hill, C. S.; Montgomery, S. A.; Brown, A. J.; Bluemling, G. R.; Natchus, M. G.; Saindane, M.; Kolykhalov, A. A.; Painter, G.; Harcourt, J.; Tamin, A.; Thornburg, N. J.; Swanstrom, R.; Denison, M. R.; Baric, R. S. An Orally Bioavailable Broad-spectrum Antiviral Inhibits SARS-CoV-2 in Human Airway Epithelial Cell Cultures and Multiple Coronaviruses in Mice. Sci. Transl. Med. 2020, 12, eabb5883

(3) Agostini, M. L.; Pruijssers, A. J.; Chappell, J. D.; Gribble, J.; Lu, X.; Andres, E. L.; Bluemling, G. R.; Lockwood, M. A.; Sheahan, T. P.; Sims, A. C.; Natchus, M. G.; Saindane, M.; Kolykhalov, A. A.; Painter, G. R.; Baric, R. S.; Denison, M. R. Small-Molecule Antiviral β-D-N4 - Hydroxycytidine Inhibits a Proofreading-Intact Coronavirus with a High Genetic Barrier to Resistance. J. Virol. 2019, 93, e01348-19.

(4) Urakova, N.; Kuznetsova, V.; Crossman, D. K.; Sokratian, A.; Guthrie, D. B.; Kolykhalov, A. A.; Lockwood, M. A.; Natchus, M. G.; Crowley, M. R.; Painter, G. R.; Frolova, E. I.; Frolov, I. β-D-N4 - Hydroxycytidine Is a Potent Anti-alphavirus Compound That Induces a High Level of Mutations in the Viral Genome. J. Virol. 2018, 92, e01965-17.

(5) Jena, N. R. Role of Different Tautomers on the Base-Pairing Abilities of Some of the Vital Antiviral Drugs used Against COVID-19. Phys. Chem. Chem. Phys. 2020, 22, 28115–28122.

(6) Cox, R. M.; Wolf, J. D.; Plemper, R. K. Therapeutically Administered Ribonucleoside Analogue MK-4482/EIDD-2801 Blocks SARS-CoV-2 Transmission in Ferrets. Nature Microbiol. 2021, 6, 11– 18.

(7) Merck and Ridgeback Bio Announce Closing of Collaboration and Licensing Transaction. Merck, July 1, 2020. https://www.merck.com/ news/merck-and-ridgeback-bio-announce-closing-of-collaboration and-licensing-transaction/ (accessed 2021-04-14).

(8) Efficacy and Safety of Molnupiravir (MK-4482) in Hospitalized Adult Participants with COVID-19 (MK-4482-001). https:// clinicaltrials.gov/ct2/show/NCT04575584 (accessed 2021-04-14).

(9) Ridgeback Biotherapeutics and Merck Announce Preliminary Findings from a Phase 2a Trial of Investigational COVID-19 Therapeutic Molnupiravir. Merck, March 6, 2021. https://www.merck.com/news/ ridgeback-biotherapeutics-and-merck-announce-preliminary-findings from-a-phase-2a-trial-of-investigational-covid-19-therapeutic molnupiravir/ (accessed 2021-04-14).

(10) Painter, G. R.; Bluemling, G. R.; Natchus, M. G.; Guthrie, D. N4-Hydroxycytidine and Derivatives and Anti-viral Uses Related Thereto. WO 2019113462, June 13, 2019.

(11) Steiner, A.; Znidar, D.; Ö tvös, S. B.; Snead, D. R.; Dallinger, D.; Kappe, C. O. A High-Yielding Synthesis of EIDD-2801 from Uridine. Eur. Eur. J. Org. Chem. 2020, 2020, 6736–6739.

(12) Miah, A.; Reese, C. B.; Song, Q. Convenient Intermediates for the Preparation of C-4 Modified Derivatives of Pyrimidine Nucleosides. Nucleosides Nucleotides 1997, 16, 53–65.
(13) Gopalsamuthiram, V.; Williams, C.; Noble, J.; Jamison, T. F.; Gupton, B. F.; Snead, D. R. A Concise Route to MK-4482 (EIDD2801) from Cytidine: Part 2. Synlett 2021, 32, 326–328.
(44) Vasudevan, N.; Ahlqvist, G. P.; McGeough, C. P.; Paymode, D. J.; Cardoso, F. S. P.; Lucas, T.; Dietz, J.-P.; Opatz, T.; Jamison, T. F.; Gupton, B. F.; Snead, D. Chem. Commun. 2020, 56, 13363–13364.
(14) (a) Ahlqvist, G. P.; McGeough, C. P.; Senanayake, C.; Armstrong, J. D.; Yadaw, A.; Roy, S.; Ahmad, S.; Snead, D. R.; Jamison, T. F. Progress Towards a Large-Scale Synthesis of Molnupiravir (MK-4482, EIDD-2801) from Cytidine. ChemRxiv 2021, DOI: 10.26434/chemrxiv.13809527.v1. (b) Paymode, D. J.; Vasudevan, N.; Ahmad, S.; Kadam, A. L.; Cardoso, F. S. P.; Burns, J.; Cook, D. W.; Stringham, R. W.; Snead, D. R. Toward a Practical, TwoStep Process for Molnupiravir from Cytidine. ChemRxiv 2021, DOI: 10.26434/chemrxiv.13550537.v1.
(15) Hu, T.; Xie, Y.; Liu, Y.; Xue, H.; Zhu, F.; Aisa, H. A.; Shen, J. A Convenient and Cost Efficient Route Suitable for "One-Pot" Synthesis of Molnupiravir. ChemRxiv 2021, DOI: 10.26434/chemrxiv.14208206.v1
(16)Dinesh J. Paymode, N. Vasudevan, Saeed Ahmad, Appasaheb L. Kadam, Flavio S.P. Cardoso, Justina M. Burns, Daniel W. Cook, Rodger W. Stringham, and David R. Snead: Toward a Practical, Two-Step Process for Molnupiravir: Direct Hydroxamination of Cytidine Followed by Selective Esterification: Org. Proces. Proce. Inter. https://doi.org/10.1021/acs.oprd.1c00033
(17) Raghunath Dey, Sourav Nayak, Parthasarathi Das and Somanath Yadav: Short Synthesis of Molnupiravir (EIDD-2801) via a Thionated Uridine Intermediate: ACS Omega https://doi.org/10.1021/acsomega.1c04550

19. Appendices (copy of questionnaire, consent forms, etc.)

*Note 1: ***All proposals are subject to initial screening. If a proposal passes initial screening it is formally accepted as an application and will enter a second screening stage comprising of a high powered committee.***

*Note 2: Submit the completed form (both hard and soft copy) to the Principal, Rcasc

Endorsement from the Head of Department*
(To be given on letter head)

Project Title: Synthesis of analogues of Molnupiravir and their Anti – Covid - 19 activity

1. Certified that the Department welcomes participation of **Dr. Hareesh Kumar P** as the Principal Investigator and **Mr. S G Prasanna Kumar** as the Principal Co-Investigator for the Project and that in the unforeseen event of discontinuance by the Principal Investigator, the Principal Co-Investigator will assume the responsibility of the fruitful completion of the Project.

Date: 30th November 2021
Place: Bengaluru

Name and Signature of Head of Department
(Prasanna Kumar S.G.)

Title of the Proposal: Synthesis of fumaramide derivatives of Lanthanum (III) complexes and their screening for AChE and BuChE inhibition activities

1. Broad Area of Research: Chemistry
2. Sub Area of Research: Bioinorganic Chemistry

Brief Introduction

Alzheimer's disease is the most common form of neurodegenerative disease which is characterized by memory loss, cognitive decline and reduced ability to perform everyday activities. Based on cholinergic hypothesis current pharmacological drugs being synthesized are mainly aimed at increasing the level of neurotransmitter acetylcholine by the inhibition of cholinesterases (ChE)[1-3]. Current approaches to the treatment of cognitive and behavioral symptoms of Alzheimer disease emphasize the use of cholinesterase inhibitors. Hence the kinetic effects of the cholinesterase inhibitors donepezil, galantamine, metrifonate, physostigmine, rivastigmine, and tetrahydroaminoacridine were examined with respect to their action on the esterase and aryl acylamidase activities of human acetylcholinesterase (AChE) and human butyrylcholinesterase (BuChE). The comparative kinetic studies suggested that though the given drugs that are currently in use for the treatment of Alzheimer disease inhibit both AChE and BuChE, the development of drugs targeted toward the exclusive inhibition of one or the other cholinesterase may be important for understanding the relative importance of inhibition of BuChE and AChE in the treatment of this disease16. Recently oxamides and fumaramides were synthesized and their cholinesterase activities were evaluated. The results implied that the presence of an ethylene bridge in the fumaramide analogues had more influence on the inhibition of AChE and BuChE[2]. Though several organic compounds with N, O, S and carbonyl derivatives show potent cholinesterase inhibition activities, there is a scope for development of drugs showing site specific activity. Some of the ligands act as better metal chelators also. But the evidence for the metal complex which acts as enzyme inhibitor is very less. Thus, there is wide scope for the development of organic ligands and their metal complexes as site-specific enzyme inhibitors[2].

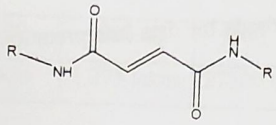
1. Background and statement of the problem

I have expertised in synthesizing oxamide derivatives and complexing them with La(III) metal.[4-7] The biochemical applications of La(III) oxamide complexes have been studied as my PhD thesis work wherein I worked on investigating the binding ability of La(III) complexes with CT-DNA, chemical nuclease activity with SC pUC 19 DNA, anticancer activities against

MCF-7 and *HeLa* cell lines, antibacterial activities, DPPH radical scavenging activities, metal chelation activities and so on. Based on this experience, I would like to investigate the enzyme inhibition activities of fumaramides and their La(III) complexes.

1. **Research question or hypothesis, aim and objectives**

The proposed project is focusing on the bioinorganic chemistry and the potential application of the ligands and their metal complexes in biological systems. The first strategy is the facile synthesis of fumaramide ligands having various substituted aromatic moiety containing electron withdrawing and electron donating groups.



Fumaramide

Then these ligands will be used to synthesize novel metal complexes containing La (III) as central metal ion. Next step is to characterize the newly synthesized ligands and the metal complexes using various spectrophotometric and elemental analyses techniques. Third and the most important part is to study/understand the biological importance of these ligands and complexes in cholinesterase enzyme inhibition activity which plays key role in preventing or slow down neurodegenerative disease like Alzheimer's disease. This enzyme inhibition activity will be tested by biochemical assays. The protein ligand/metal complex interaction in the active site pocket of the enzyme will be studied by molecular docking techniques. The importance of these studies comes from the very potent applications of these fumaramide ligands as well as the metal complexes as therapeutic agents in many Alzheimer's diseases.

2. **Research design**

1) Synthesis of fumaramide ligands and La(III) metal complexes by conventional methods

2) Structural characterization by spectroscopic and analytical methods

3) Investigation of biological activities: Protein binding studies, substrate inhibition assays – Kinetics studies

4) *In silico* screening of the molecules with AChE and BuChE enzymes

7. Resources

Sl. No	

3. **Data collection methods and instruments**

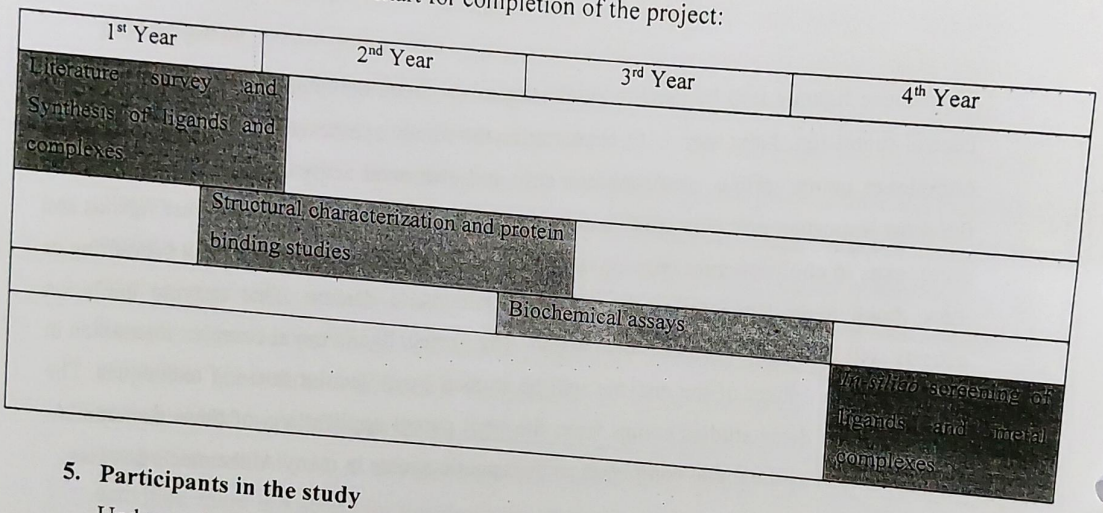
The primary characterization techniques of these materials include single crystal X-ray diffraction (SCXRD), powder diffraction, UV Visible Absorption and Emission, Cyclic voltammetry, Conductometry, IR analysis, ^{1}H-NMR and ^{13}C – NMR, ESI-Mass Spectrometry (samples to be sent out for these analyses). The protein binding assays and biochemical assays will be carried out by using UV-visible spectrometer for the kinetics studies.

Note: Few of the instrumentation facilities will be availed and supported at Department of Chemistry, MSRIT Campus.

4. **Data analysis methods**

For this project the methods for data interpretation consist of Origin, MS Excel, Autodock and Autodock Vina.

Research Schedule-Bar chart for completion of the project:



5. **Participants in the study**

Under graduate and post graduate students may work in this project as part of their internship, summer and winter projects, MSc project, and other academic activities.

6. **Ethical considerations**

Any scientific contribution to this work by a person or an institute will be acknowledged and the authorship will be shared if needed.

7. Resources required for the study, including budget

Sl. No	Item	BUDGET				Amount (In Rupees)
		1st Year	2nd Year	3rd Year	4th Year	Total
1.	Equipment	2 lakhs	1 lakh	-	-	3 lakhs
2.	Consumables	20000.00	20000.00	20000.00	5000.00	65000.00
3.	Research Assistant	NA	NA	NA	NA	NA
4.	Travel	-	2500.00	2500.00	-	5000.00
5.	Other costs	6000.00	5000.00	5000.00	4000.00	20000.00
	Grand total	2.26 lakhs	1.275 lakhs	27500.00	9000.00	3.9 lakhs

7.1. Justification for consumable: For buying glass apparatus, specific chemicals such and solvents, Magnetic stirrer with hot plate, refluxing unit, BSA protein, enzymes, and substrates for biochemical assays

7.2. Justification for Equipment: The protein binding studies will be studies using the Melting point apparatus and Viscometer with Thermostat.

7.3. Justification for other costs: The samples may be sent out for other characterizations and charges are applicable for it. Other costs include the stationeries purchased for the lab.

8. Scientific Impact, dissemination and potential exploitation

Alzheimer's disease (AD) is the most common form of neurodegenerative disease that occurs in the central nervous system. The major causes for the disease can be attributed to the hydrolysis of neurotransmitter acetylcholine by the two enzymes acetyl choline esterase and butyryl choline esterase, aggregation of β-amyloid proteins which cause formation of plaques in the nerve cells etc. Rivastigmine, galantamine and donepezil only offer symptomatic relief and do not show any disease modifying effects. Tacrine has shown serious hepatotoxic effects. On viewing all these facts, we are focusing on the development of new molecules as potent drugs which show high efficiency and cause no or less side effects. Reduction in the activity of the cholinergic neurons is a well-known feature of Alzheimer's disease. We are focusing on evaluating the enzyme inhibition activity of these ligands and lanthanum (III) metal complexes against acetylcholine esterase and butyrylcholine esterase enzymes and thereby developing novel potent drugs for Alzheimer's disease.

9. References

1. Henryk Kozlowski, Marek Luczkowski, Maurizio Remelli, Daniela Valensin. Coord. *Chem. Rev.*, 2012.
2. Kadir Ozden Yerdelen, Edip Tosun. *Medicinal Chemistry Research*, 2015, 24, 588-602.
3. Alicja Skrzypek, Joanna Matysiak, Andrzej Niewiadomy, Marek Bajda, Pawel Szymanski. *Eur. J. Med. Chem.*, 2013, 62, 311-319.
4. Vibha Vinayakumar Bhat, P. R. Chetana, Fluorescence studies of Lanthanum (III) complexes of N, N′ bis-(alkyl/aryl)-substituted oxamides and phenanthroline bases, *Res. J. Chem. Env.*,2020, 24, 88 – 95.
5. P. R. Chetana, D. R. Navya, Vibha Vinayakumar Bhat, B. S. Srinatha, Mohan A. Dhale, Studies on DNA interactions and Biological Activities of Lanthanum(III) Complexes with 4-quinoline terpyridine and 1,10-phenanthroline. *Asian J. Chem.*, 2019, 6, 1265-1274
6. P. R. Chetana, Vibha Vinayakumar Bhat, Mohan A. Dhale, Hetero-binuclear complexes of lanthanum(III) using bridging N,N′-bis(2-pyridylmethyl)oxamide and terminal 1,10-phenanthroline: Syntheses, characterization and DNA interactions. *Int. J. Pharm. Sci. Drug Res.* 2018; 10(6): 460-473
7. P. R. Chetana, Vibha Vinayakumar Bhat, Mohan A. Dhale, DNA interactions, antibacterial and antioxidant studies of newly synthesized lanthanum(III) complexes using N,N′-bis(3-pyridylmethyl) oxamide and N,N-heterocyclic bases. *Int. J. Pharm. Sci. Rev. Res.* 2018, 49, 86-99

List of publications

1. **Vibha Vinayakumar Bhat**, P. R. Chetana, Fluorescence studies of Lanthanum (III) complexes of N, N′ bis-(alkyl/aryl)-substituted oxamides and phenanthroline bases, *Res. J. Chem. Env.*, 2020, 24, 88 – 95
2. P. R. Chetana, D. R. Navya, **Vibha Vinayakumar Bhat**, B. S. Srinatha, Mohan A. Dhale, Studies on DNA interactions and Biological Activities of Lanthanum(III) Complexes with 4-quinoline terpyridine and 1,10-phenanthroline. *Asian J. Chem.*, 2019, 6, 1265-1274
3. P. R. Chetana, **Vibha Vinayakumar Bhat**, Mohan A. Dhale, Hetero-binuclear complexes of lanthanum(III) using bridging N,N′-bis(2-pyridylmethyl)oxamide and terminal 1,10-phenanthroline: Syntheses, characterization and DNA interactions. *Int. J. Pharm. Sci. Drug Res.* 2018; 10(6): 460-473

4. P. R. Chetana, **Vibha Vinayakumar Bhat**, Mohan A. Dhale, DNA interactions, antibacterial and antioxidant studies of newly synthesized lanthanum(III) complexes using N, N′-bis(3-pyridylmethyl) oxamide and N,N-heterocyclic bases. *Int. J. Pharm. Sci. Rev. Res.* 2018, 49, 86-99.
5. **Ramya Kumari B. S**. "Ongoing Clinical and Immunization Trials for Novel Zoonotic Covid -19 Pandemic" *Sumerianz J. Biotech.*, 2021, Vol. 4, No. 2, pp. 85-93 ISSN(e): 2617-3050, ISSN(p): 2617-3123
6. Malla Sudhakar, **Ramya Kumari B. S**., Poornashree M., Ankitha Gour, and Sahani Sultana and Saroj Mahala" Antiurolithiatic activity of neem leaves in existing renal calculi by invitro methods" *Eur. J. Biomed. Pharm. Sci.*, 2016, Vol. 3, issue.3 214-217.
7. Malla Sudhakar, **Ramya Kumari B. S**., Kiran H K, Basavaraj M B, Gowthami K, Savitha M V, and Purushotham R "possible heavy metal (Pb, Mn, & Cu) accumulation in fresh water and waste water irrigated vegetables." *Eur. J. Biomed. Pharm. Sci*., 2016, Vol.3 isuue.9, 167-170.

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Approved by Government of Karnataka, Approved by AICTE, New Delhi,
Recognized by UGC under 2F & 12B of UGC act 1956

Endorsement from the Head of Department

Project Title: Synthesis of fumaramide derivatives of Lanthanum(III) complexes and their screening for AChE and BuChE inhibition activities

Certified that the Department welcomes participation of **Dr. Vibha Vinayakumar Bhat** as the Principal Investigator for the Project and that in the unforeseen event of discontinuance by the Principal Investigator, the Principal Co-Investigator (**Mrs. Ramya Kumari B S, Dept. of Chemistry**) will assume the responsibility of the fruitful completion of the Project.

Date: 31-11-2021
Place: Bengaluru

(H.O.D)
Head of the Department
Mr. Prasanna Kumar, S.G.
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Recognized by UGC under 2F & 12B of UGC act 1956

Certificate from the Investigator

Project Title: Synthesis of fumaramide derivatives of Lanthanum(III) complexes and their screening for AChE and BuChE inhibition activities

1. We agree to abide by the terms and conditions of the research grant.
2. We did not submit the Project proposal elsewhere for financial support.
3. We have explored and ensured that equipment and basic facilities will actually be available as and when required for the purpose of the Projects.
4. We undertake that on permanent equipment will be made available to other users during spare time.

Date: 31-11-2021
Place: Bengaluru

Dr. Vibha Vinayakumar Bhat (PI)

Mrs. Ramya Kumari B S (Co-PI)

The above project is Approved/ Not Approved

Comments:

Signatures of the committee Members

Signature of the Principal

1.

2.

3.

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Research and Development Fund

Format for submitting the Research Proposal

Name of the Principal Investigator	**Dr. SHASHIDHAR BHARADWAJ S.**
Qualification	M.Sc., Ph.D.
Affiliation	M. S. Ramaiah College of Arts, Science and Commerce
Department	CHEMISTRY
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Papers Published in the research area (Attach brief profile)	**07** Nos. – Peer Reviewed UGC journals

Name of the Co-investigator	**Dr. SAMRAT K**
Qualification	Assistant Professor
Department	Department of Biotechnology
Affiliation	MSRIT
Address , Phone Number and e-mail	MSR Nagar, MSRIT Post Bangalore, PIN- 560 054 Karnataka INDIA Email : samrat@msrit.edu
Papers Published in the research area(Attach brief profile)	**10** Nos.

1. Title of the Proposal... **"Design, Synthesis and Evaluation of Quinoline Hybrids as Novel Inhibitors against the *P. Falciparum Dihydrofolate Reductase* (*Pfdhfr*) of Possible Promising Antimalarial: Investigation of Antimalarial Activities"**
2. Broad Area of Research **"Bio-Organic and Medicinal Chemistry"**
3. Sub Area of Research **"Organic Chemistry"**

4. ***Brief Introduction*****.....*****(Max 500 words)***

Development of a lead molecule and a much effective drug (having low molecular weight with desired properties) against known targets, has been a challenging work. Nowadays, drug discovery has significantly scooped up, due to the availability of sophisticated 3D X-ray images, NMR structures of biomolecules, docking tools and advancing towards computer aided methodologies.

Malaria is one of the most widespread and deadliest diseases that resulted in 212 million clinical cases and 429,000 deaths in 2015 alone, It has estimated that in every year 200 million people will get disease globally according to the World Health Organization (WHO) report.

Malaria is usually caused by protozoan parasites of the genus Plasmodium including *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi* species of human malaria parasite. In particular, *P. falciparum* is the most fatal one, which is responsible for 95% of the case of death. The life cycle of malaria parasites is rather complex. Hereinto, the erythrocytic stage is responsible for the diverse symptoms caused by infection. It is known that hemoglobin degradation and hemozoin formation are essential for parasite survival, making these processes important targets for antimalarials development. Heme detoxification into hemozoin was believed to be the main target of quinoline antimalarials and remained one of the most attractive drug development targets.

Looking for the structures with propitious/providential bioactivity, many chemists focused their investigation on quinoline and its congeners which have surprisingly came up as diverse and potent antimalarial drugs. Quinoline as a core moiety, containing some fused heterocyclic rings as antimalarial drugs ever used are Mefloquine, Quinacrine, Chloroquine, hydrochloroquine, Amodiaquine, Quinine, Primaquine, Pamaquine, Pentaquine, Isopentaquine, Pyrimethamine, Tafenoquine and Piperaquine.

The literature reveals that Quinoline hybrids acts against the malaria parasites by blocking haemozoin formation through π-π stacking of the substituted quinoline core to the heme ring system or by docking into grooves on the haemozoin crystal and preventing further crystal growth. The toxic haematins then leave the digestive vacuole and enter into the parasite cytosol where oxidative membrane damage is induced.

In order to substantiate the observed activity profile and to provide insight into the mechanisms of action of the hybrids, molecular docking studies can be performed into the binding pocket of P. falciparum dihydrofolate reductase (PfDHFR) considering both the wild type (1J3I.pdb) and a quadruple mutant (N51I, C59R, S108 N, I164L, 3QG2.pdb).

5. **Background and statement of the problem (this in the light of a thorough National and International literature review) ..... (Max 500 words)**

The present-day scenario is to encourage the growth of high-quality interdisciplinary research, which now thrive in many institutions. In this context the proposed project interfaces the chemistry and biology and thus has the interdisciplinary relevance. Novel Quinoline hybrids will be synthesized by making use modern synthetic technique and the resulting molecules will be screened for their antimalarial properties. Review of status of Research and Development in the subject. A new group of highly active quinoline hybrids have set new standards in medicine and malarial with respect to efficacy and range of disease control spectrum. Among this group, we find the most active compounds known today for control of Plasmodium including *P. Falciparum, P. vivax, P. malariae, and P. ovale.*

6. **Research question or hypothesis, aim and objectives..... (Max 300 words)**

The proposed work of synthesizing novel heterocyclic compounds having quinoline are expected to display better antimalarial activity. The findings of the research outcome will be published as and when data is available in leading international and national journals with an intention to disseminate the knowledge and the project is intended to explore the possibility of understanding the malarial properties of the molecules designed for the synthesis. Synthesis of these heterocycles and their malarial data would be useful in making the proper conclusion of the proposed work.

The objective of this proposal is to synthesis quinoline hybrids, to substitute the chlorine atom by halogenated aryloxy groups, to screen the above synthesized

compounds against Plasmodium including *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi* and to understand the effects quinoline hybrids and halogenated aryloxy substituents attached quinoline hybrids,to characterize the compounds by FT-IR, NMR, LC-MASS and single crystal X-ray spectral studies, to screen the above synthesized compounds through Molecular docking studies and investigate the binding pocket of *P. falciparum dihydrofolate reductase* (*PfDHFR*).

7. **Research design (type of study) ..... (Max 300 words)**

1. To synthesis quinoline hybrids.
2. To substitute the chlorine atom by halogenated aryloxy groups.
3. To screen the above synthesized compounds against Plasmodium including *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi* and to understand the effects quinoline hybrids and halogenated aryloxy substituents attached quinoline hybrids.
4. To characterize the compounds by FT-IR, NMR, LC-MASS and single crystal X-ray spectral studies.
5. To screen the above synthesized compounds through Molecular docking studies and investigate the binding pocket of *P. falciparum dihydrofolate reductase* (*PfDHFR*).

8. **Study population and sampling (If applicable) .....**

The present work is based on to screen the above synthesized compounds against Plasmodium including *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi* and to understand the effects of quinoline hybrids and halogenated aryloxy substituents attached quinoline hybrids.

9. **Data collection methods and instruments..... (Max 300 words)..**

a. **<u>Synthesis quinoline hybrids</u>**

Synthesize a substituted chlorine atom by halogenated aryloxy groups and characterize the compounds by FT-IR, NMR, LC-MASS and single crystal X-ray spectral studies.

b. **<u>Biological activity</u>**

To screen the above synthesized compounds against Plasmodium including *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi* and to understand

the effects quinoline hybrids and halogenated aryloxy substituents attached quinoline hybrids.

c. ***In silico* Molecular Docking studies**

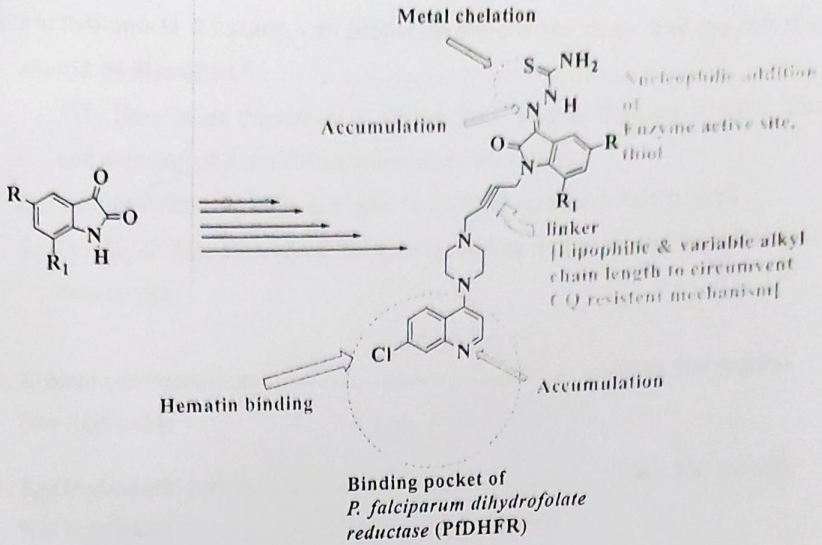
To screen the above synthesized compounds through Molecular docking studies and investigate the binding pocket of *P. falciparum* dihydrofolate reductase (PfDHFR).

10. **Data analysis methods – if applicable statistical planning must be fully addressed, or the candidate should provide evidence that statistics are not required**

In the proposed project the synthesized products will be characterized by the following methods and techniques

a. Synthesis of *N*- propargylated isatin 7-chloroquinoline hybrids via Cu-mediated Mannich reaction
b. HPLC and Chromatographic techniques for the separation of compounds.
c. Characterization by Spectroscopic techniques like FTIR, ^{1}H-NMR, ^{13}C-NMR, Elemental analyses, Single crystal XRD and LC Mass
d. Screening of the synthesized compounds through Molecular docking studies and investigate the binding pocket of p. *falciparum dihydrofolate reductase* (pfDHFR).
e. Screening of the synthesized compounds against Plasmodium including P. *Falciparum, P. vivax, P. malariae, P. ovale and P. knowlesi* and to understand the effects quinoline hybrids.

11. **Mechanisms to assure the quality of the study – e.g. control of bias, safe storage of data…. (Max 300 words)**



Binding pocket of
P. falciparum dihydrofolate reductase (PfDHFR)

12. **Research Schedule -Bar chart for completion of the project.....**

The work distribution for 24 months will be as follows:

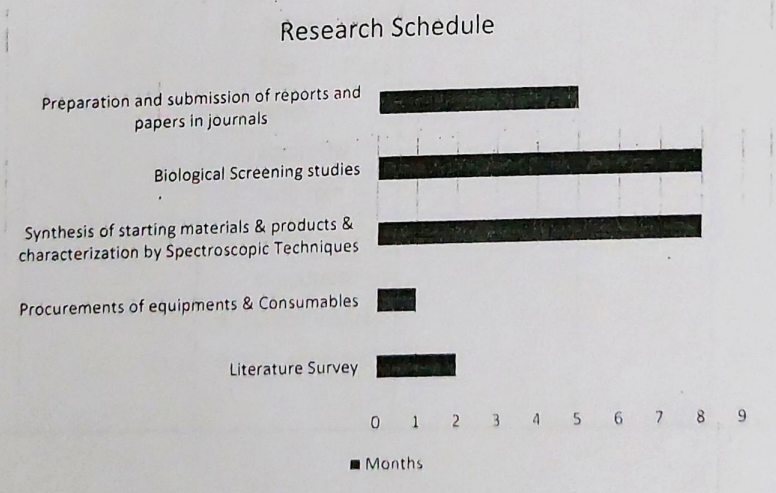
a) Literature Survey - **2** months

b) Procurements of equipment's & consumables - **1** months

c) Synthesis of the starting materials & products & characterization by Spectroscopic Techniques - **8** months

d) Biological screening studies - **8** months

e) Preparation and submission of reports and papers in journals - every **5** months



13. **Participants in the study – all people involved in the study, and the role they play, should be identified.*.....**

1. *Dr. Shashidhar Bharadwaj S. (PI) & Prof. Sridhar Rajaram (Co-PI) -Designing and planning of experiments/Analysis of the results
2. Dr. Shashidhar Bharadwaj S. and M.Sc/Ph.D students - Bench work
3. Dr. Shashidhar Bharadwaj S.- Corresponding author of the technical report and manuscript.

14. **Ethical considerations.....(Max 300 words)**

Not Applicable

15. **Environmental Issues.....(Max 300 words)**

Not Applicable

16. **Resources required for the study, including budget (Personnel, Consumables, Equipment, Travel, Subcontracting, Provisions, Licensing fees, other).....**

Sl. No	Item	BUDGET			Amount (In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	Equipment	1. TLC-UV Cabinet 2. Magnetic Stirrer With Hot Plate temp controller with rpm 3. rotary evaporator 4. Glass wears 5. TLC plates			2.0 Lack

2.	Consumables	1. Starting material Chemicals 2. Reagents 3. Solvents 4. Catalyst 5. Magnetic stirrer			2.0 Lack
3.	Research Assistant	Nil	Nil		
4.	Travel	Nil	Nil		
5.	Other costs		Outsourcing samples for characterization by Spectroscopic and Biological screening studies		1.00 Lack
	Grand total	4 Lacks	1 Lack		**5 Lacks**

a. Justification for the manpower requirement:

Project work will be accomplished as M.Sc students projects and also for expected Ph.D. fellows from RUSA

b. Justification for consumable:

Consumable of this project mainly include heating mantel, condenser, R.B flask, Beakers, test tubes, funnels, TLC plates, UV light chamber etc. These are the essential requirements and planned to get from vendor with minimum cost without compromising with the quality of the product

c. Justification for Equipment:

Minimum equipment required for putting a reaction in the lab is proposed. Fuming wood will be used from M.Sc. chemistry lab. To monitor the completion of reaction with the help of TLC, UV light chamber is used which needs to be set up in the organic lab.

d. Justification for other costs:

Outsourced samples for other experiments including the assay for the above synthesized compounds against Plasmodium including *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi* can be done

17. **Scientific Impact, dissemination and potential exploitation (Max 300 words)**

Malaria is one of the most widespread and deadliest diseases that resulted in 212 million clinical cases and 429,000 deaths in 2015 alone, It has estimated that in every year 200 million people will get disease globally according to the World Health Organization (WHO) report. Malaria is usually caused by protozoan parasites of the genus Plasmodium including *P. falciparum, P. vivax, P. malariae, P. ovale* and *P. knowlesi* species of human malaria parasite. In particular, *P. falciparum* is the most fatal one, which is responsible for 95% of the case of death. The life cycle of malaria parasites is rather complex. Hereinto, the erythrocytic stage is responsible for the diverse symptoms caused by infection. It is known that hemoglobin degradation and hemozoin formation are essential for parasite survival, making these processes important targets for antimalarials development. Heme detoxification into hemozoin was believed to be the main target of quinoline antimalarials and remained one of the most attractive drug development targets.

Project result will be presented in national and international conferences and communicated to UGC listed journals

18. **References……(Max 50)……**

1. J. Greer, J. W. Erickson, J. J. Baldwin, M. D. Varney, *J. Med. Chem.*, 1994, **37**, 1035-1054.
2. B. A. Muller, *Curr. Pharm. Des.*, 2009, **15**, 120-133.
3. T. Chua, C. L. Moore, M. B. Perri, S. M. Donabedian, W. Masch, D. Vager, S. L. Davis, K. Lulek, B. Zimnicki, M. J. Zervos, *J. Clin. Microbiol.*, 2008, **46**, 2345-2352.
4. D. T. Chu, J. J. Plattner, L. Katz, *J. Med. Chem.*, 1996, **39**, 3853-3874.
5. S. Kumar, S. Bawa, H. Gupta, *Mini Rev. Med. Chem.*, 2009, **9**, 1648-1654.
6. K. Kaur, M. Jain, R. P. Reddy, R. Jain, *Eur. J. Med. Chem.*, 2010, **45**, 3245-3264.

7. Y. L. Chen, Y. L. Zhao, C. M. Lu, C. C. Tzeng, J. P. Wang, *Bioorg. Med. Chem.*, 2006, **14**, 4373-4378.
8. G. Ramaprasad, B. Kalluraya, B. S. Kumar, S. Mallya, *Med. Chem. Res.*, 2013, **22**, 5381-5389.
9. N. Ingale, V. Maddi, M. Palkar, P. Ronad, S. Mamledesai, A. Vishwanathswamy, D. Satyanarayana, *Med. Chem. Res.*, 2012, **21**, 16-26.
10. B. Jayashankar, K. L. Rai, N. Baskaran, H. Sathish, *Eur. J. Med. Chem.*, 2009, **44**, 3898-3902.
11. H. Kumar, S. A. Javed, S. A. Khan, M. Amir, *Eur. J. Med. Chem.*, 2008, **43**, 2688-2698.
12. C. Velázquez, P. P. Rao, R. McDonald, E. E. Knaus, *Bioorg. Med. Chem.*, 2005, **13**, 2749-2757.
13. C. Ainsworth, W. Buting, J. Davenport, M. Callender, M. McCowen, *J. Med. Chem.*, 1967, **10**, 208-211.
14. R. A. Rane, S. D. Borhade, P. K. Khandare, *Eur. J. Med. Chem.*, 2013, **70**, 49-58.
15. R. A. Rane, S. D. Gutte, N. U. Sahu, *Bioorg. Med. Chem. Lett.*, 2012, **22**, 6429-6432.
16. Y. Li, Y. Luo, Y. Hu, D. D. Zhu, S. Zhang, Z. J. Liu, H. B. Gong, H. L. Zhu, *Bioorg. Med. Chem.*, 2012, **20**, 4316-4322.
17. M. A. Bakht, M. S. Yar, S. G. Abdel-Hamid, S. I. Al Qasoumi, A. Samad, *Eur. J. Med. Chem.*, 2010, **45**, 5862-5869.
18. A. M. Dodiya, N. R. Shihory, N. Desai, *Synth. Commun.*, 2012, **42**, 3230-3241.
19. M. Amon, X. Ligneau, J. C. Schwartz, H. Stark, *Bioorg. Med. Chem. Lett.*, 2006, **16**, 1938-1940.
20. P. Tosco, M. Bertinaria, A. Di Stilo, C. Cena, G. Sorba, R. Fruttero, A. Gasco, *Bioorg. Med. Chem.*, 2005, **13**, 4750-4759.
21. S. Lorenzi, M. Mor, F. Bordi, S. Rivara, M. Rivara, G. Morini, S. Bertoni, V. Ballabeni, E. Barocelli, P. V. Plazzi, *Bioorg. Med. Chem.*, 2005, **13**, 5647-5657.
22. G. A. Gfesser, H. Zhang, J. Dinges, G. B. Fox, J. B. Pan, T. A. Esbenshade, B. B. Yao, D. Witte, T. R. Miller, C. H. Kang, *Bioorg. Med. Chem. Lett.*, 2004, **14**, 673-676.

23. J. Clitherow, P. Beswick, W. Irving, D. Scopes, J. Barnes, J. Clapham, J. Brown, D. Evans, A. Hayes, *Bioorg. Med. Chem. Lett.*, 1996, **6**, 833-838.

24. S. Joshi, Y. More, H. Vagdevi, V. Vaidya, G. Gadaginamath, V. Kulkarni, *Med. Chem. Res.*, 2013, **22**, 1073-1089.

25. M. J. Ahsan, J. G. Samy, H. Khalilullah, M. S. Nomani, P. Saraswat, R. Gaur, A. Singh, *Bioorg. Med. Chem. Lett.*, 2011, **21**, 7246-7250.

26. M. A. Ali, M. Shaharyar, *Bioorg. Med. Chem. Lett.*, 2007, **17**, 3314-3316.

27. G. S. Kumar, Y. Rajendraprasad, B. Mallikarjuna, S. Chandrashekar, C. Kistayya, *Eur. J. Med. Chem.*, 2010, **45**, 2063-2074.

28. R. R. Kumar, S. Perumal, J. C. Menéndez, P. Yogeeswari, D. Sriram, *Bioorg. Med. Chem.*,2011, **19**, 3444-3450.

29. K. P. Harish, K. N. Mohana, L. Mallesha, B. Veeresh, *Arch. Pharm.*,2014, **347**, 256-267.

30. S. Ubaradka, A. M. Isloor, P. Shetty, P. Shetty, N. A. Isloor, *Med. Chem. Res.*, 2013, **22**, 1497-1503.

31. H. Rajak, P. Singour, M. D. Kharya, P. Mishra, *Chem. Biol. Drug Des.*, 2011, **77**, 152-158.

32. J. W. Watthey, M. Desai, R. Rutledge, R. Dotson, *J. Med. Chem.*, 1980, **23**, 690-692.

33. Z. Li, P. Zhan, X. Liu, *Mini Rev. Med. Chem.*, 2011, **11**, 1130-1142.

34. R. Pratap, V. Yarovenko, *Nucleosides, Nucleotides, Nucleic Acids*, 2000, **19**, 845-849.

35. M. Kalhor, A. Dadras, *J. Heterocycl. Chem.*, 2013, **50**, 220-224.

36. L. Fernandez, M. Santo, M. Reta, L. Giacomelli, R. Cattana, J. Silber, M. Risso, H. Cerecetto, M. Gonzalez, C. Olea Azar, *Molecules*, 2005, **10**, 1197-1208.

37. S. Cao, X. Qian, G. Song, Q. Huang, *J. Fluorine Chem.*, 2002, **117**, 63-66.

38. W. Shi, X. Qian, G. Song, R. Zhang, R. Li, *J. Fluorine Chem.*, 2000, **106**, 173-179.

39. J. Sun, H. Zhu, Z. M. Yang, H. L. Zhu, *Eur. J. Med. Chem.*, 2013, **60**, 23-28.

40. A. S. Aboraia, H. M. A. Rahman, N. M. Mahfouz, M. A. E. Gendy, *Bioorg. Med. Chem.*, 2006, **14**, 1236-1246.

41. X. M. Zhang, M. Qiu, J. Sun, Y. B. Zhang, Y. S. Yang, X. L. Wang, J. F. Tang, H. L. Zhu, *Bioorg. Med. Chem.*, 2011, **19**, 6518-6524.

42. I. Khan, A. Ibrar, N. Abbas, *Arch. Pharm.*, 2014, **347**, 1-20.

43. S. Dash, B. A. Kumar, J. Singh, B. Maiti, T. Maity, *Med. Chem. Res.*, 2011, **20**, 1206-1213.

44. X. Ouyang, E. L. Piatnitski, V. Pattaropong, X. Chen, H. Y. He, A. S. Kiselyov, A. Velankar, J. Kawakami, M. Labelle, L. Smith, *Bioorg. Med. Chem. Lett.*, 2006, **16**, 1191-1196.

45. C. Feng, L. Wang, Y. Yan, J. Liu, S. Li, *Med. Chem. Res.*, 2012, **21**, 315-320.

46. K. L. Rai, N. Linganna, *Il Farmaco*, 2000, **55**, 389-392.

47. W. R. Tully, C. R. Gardner, R. J. Gillespie, R. Westwood, *J. Med. Chem.*, 1991, **34**, 2060-2067.

48. G. D. Diana, D. L. Volkots, T. J. Nitz, T. R. Bailey, M. A. Long, N. Vescio, S. Aldous, D. C. Pevear, F. J. Dutko, *J. Med. Chem.*, 1994, **37**, 2421-2436.

49. A. Milyutin, L. Amirova, V. Kolla, F. Y. Nazmetdinov, L. Drovosekova, Y. S. Andreichikov, *Pharm. Chem. J.*, 1998, **32**, 422-424.

50. R. R. Somani, A. G. Agrawal, P. P. Kalantri, P. S. Gavarkar, E. Clercq, *Int. J. Drug Des. Dis.*, 2011, **2**, 353-360.

19. **Appendices (copy of questionnaire, consent forms, etc.)**

Not Applicable

*Note 1: ***All proposals are subject to initial screening. If a proposal passes initial screening it is formally accepted as an application and will enter a second screening stage comprising of a high powered committee.***

***Note 2: Submit the completed form (both hard and soft copy) to the Principal, RCASC**

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Re-accredited 'A' by NAAC, Permanently Affiliated to Bengaluru Central University,
Approved by Government of Karnataka, Approved by AICTE, New Delhi,
Recognized by UGC under 2F & 12B of UGC act 1956

Endorsement from the Head of Department*

(To be given on letterhead)

Project Title: Project Title: Design, Synthesis and Evaluation of Quinoline Hybrids as Novel Inhibitors against the *P. Falciparum Dihydrofolate Reductase* (*Pfdhfr*) of Possible Promising Antimalarial: Investigation of Antimalarial Activities

1. Certified that the Department welcomes the participation of **Dr. Shashidhar Bharadwaj S.** as the Principal Investigator and **Dr. Samrat K.** as the Principal Co-Investigator for the Project and that in the unforeseen event of discontinuance by the Principal Investigator, the Principal Co-Investigator will assume the responsibility of the fruitful completion of the Project.

Date: 30-11-2021

Place: Bangalore

Name and Signature of Head of Department

Head of the Department
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Certificate from the Investigator

Project Title: Design, Synthesis and Evaluation of Quinoline Hybrids as Novel Inhibitors against the *P. Falciparum Dihydrofolate Reductase* (*Pfdhfr*) of Possible Promising Antimalarial: Investigation of Antimalarial Activities

1. I/ We agree to abide by the terms and conditions of the research grant.

2. I/ We did not submit the Project proposal elsewhere for financial support.

3. I/ We have explored and ensured that equipment and basic facilities will actually be available as and when required for the purpose of the Projects.

4. I/ We undertake that on permanent equipment will be made available to other users during spare time.

Date:
Place:

Dr. Shashidhar Bharadwaj. S.
Name and signature of Principal Investigator

Date:
Place:

Dr. Samrat. K Samrat. K 18/12/21
Name and signature of Co- Investigator

The above project is Approved / Not Approved

Comments:

Signatures of the committee Members

Signature of the Principal

1.

2.

3.

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Recognized by UGC under 2f & 12B of UGC act 1956

Date: 14.02.2022

To,
Dr. Chandraprabha M N
Professor and Head
Dept of Biotechnology
MSRIT
Bengaluru

Dear Madam,

Subject: Request to scrutinize the Research Proposal for Seed Money grant.

With reference to the above subject, the research proposal for Seed Money grant has been received from our faculty member.

I request you to kindly scrutinize the proposal and provide a convenient date and time for the presentation.

Thanking you

Regards

Dr. A. Nagarathna
Principal,
M.S. Ramaiah College of Arts, Science & Commerce
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Bangalore - 560 054

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Research and Development Fund

Format for submitting the Research Proposal

Name of the Principal Investigator	Dr. M. Vidya
Qualification	Ph.D
Affiliation	Ramaiah College of Arts, Science and Commerce
Department	Chemistry and Biochemistry
Address , Phone Number and e-mail	Ramaiah College of Arts, Science and Commerce, Bengaluru Ph: +91 9008488931 vidya_biochem@msrcasc.edu.in
Papers Published in the research area (Attach brief profile)	4

Name of the Co-investigator	Dr. Krishna Murthy
Qualification	Ph.D
Department	Biotechnology
Affiliation	Ramaiah Institute of Technology
Address , Phone Number and e-mail	Ramaiah Institute of Technology, Bengaluru Ph: +91 95385 41385 krishnamurthytp@msrit.edu
Papers Published in the research area (Attach brief profile)	10

1. Title of the Proposal: **In silico and In vitro screening of natural products for Triple Negative Breast Cancer**
2. Broad Area of Research – **Drug discovery and Development**
3. Sub Area of Research – **Bioinformatics and Natural Products**

4. Brief Introduction (Max 500 words)

Introduction

Breast cancer is a heterogeneous disease with clinical, histological, and molecular subgroups. Triple negative breast cancer (TNBC) is a highly metastasized, heterogeneous illness that accounts for 15% of all instances of breast cancer and is defined by tumours that do not express oestrogen receptor (ER), progesterone receptor (PR), or overexpress human epidermal growth factor receptor 2 (HER2) [1]. Because the cancer cells lack these proteins, hormone therapy and drugs that target HER2 are not helpful, so chemotherapy (chemo) is the main systemic treatment option and although TNBC tends to respond well to initial chemo, it tends to come back (recur) more frequently than other breast cancers. Within the first 3–5 years of follow-up, TNBC is linked to a poor prognosis and a significant chance of distant recurrence and death. Given the aggressive nature of TNBC, a precise diagnosis is critical for assessing prognosis and ensuring that patients receive the best possible treatment [2]. Computer-aided drug design (CADD) approaches are becoming increasingly important in drug development, and they are vital in identifying viable therapeutic candidates at a low cost. These computational tools are useful for reducing the usage of animal models in pharmacological research and for assisting in the rational development of novel and safe drugs, supporting pharmacologists and medicinal chemists during drug discovery process [3].

Medicinal herbs and their derivative phytocompounds are being increasingly recognized as useful complementary treatments for cancer. The anticancer properties of plants have been recognized for centuries [4]. A large volume of clinical studies have reported the beneficial effects of herbal medicines on the survival, immune modulation, and quality of life (QOL) of cancer patients [5]. The anticancer characteristics of a number of plants are still being actively researched and some have shown promising results. In the present study, we are focusing on the natural phytocompounds in Triple Negative Breast Cancer Cells in in silico studies.

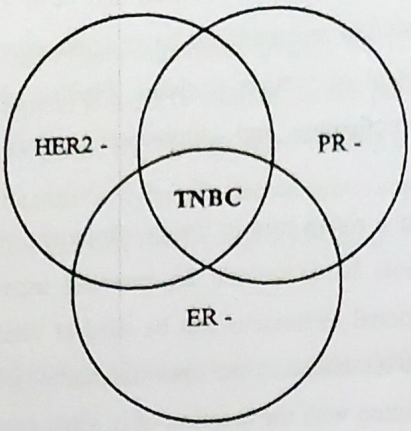


Figure 1. *Triple-negative breast cancer. HER2: Human epidermal growth factor receptor 2; PR: progesterone receptor; ER: estrogen receptor; TNBC: triple-negative breast cancer.*

(Adopted from Damaskos etal 2019 [6]

5. Background and statement of the problem (this in the light of a thorough National and International literature review)…….. (Max 500 words)

Background of the study

Breast cancer is the most common cancer among women worldwide, and it is the second largest cause of mortality after lung cancer (23 percent of all new cancer cases) [7]. TNBC is a breast cancer phenotype in which the oestrogen and progesterone receptors are negative, as shown by immunohistochemistry (IHC), and there is no overexpression of HER2 as determined by IHC or no gene amplification as determined by the fluorescence in situ hybridization technique [8]. TNBC has a higher propensity for aggressive behaviour than other kinds of breast cancer. There are no approved targeted treatments for advanced TNBC that expresses programmed cell death ligand 1, unlike other breast cancer subtypes (ER-positive, HER2 positive). However, immunotherapy (in combination with chemotherapy) is feasible for those with advanced TNBC that expresses programmed cell death ligand 1. (PD-L1). TNBC is more typically found in women under the age of 40 [9].

One of the most significant global concerns is the development of effective cancer therapies. Conventional cancer medicines have been at the forefront of the fight against cancer, but natural herbs have been used for cancer treatment in most parts of the world for centuries [10]. The beneficial effects of plant based active components

in cancer treatment have been extensively researched and have yielded promising results. Furthermore, various studies and research have demonstrated the beneficial effects of plants in the treatment of various diseases. Finding plant based active components that replace chemotherapy and cumbersome cures of cancer with cytotoxic effects is necessary.

With in silico methods playing a rising role in the development of commercialised medications, computational tools have become an essential aspect of most drug discovery processes. Computational techniques can be used at various stages of the process, from target selection to hit detection and optimization [11]. In silico methods are primarily utilised in conjunction with the creation of in vitro data to construct and test the model. The development and optimization of novel compounds with affinity for a target, as well as the elucidation of absorption, distribution, metabolism, excretion, and toxicity features, as well as physicochemical characterisation, have all benefited from such models. The development of novel treatments is a difficult, expensive, and time-consuming process. With the number of approved pharmaceuticals gradually decreasing and costs rising, a reasonable method to facilitating, expediting, and streamlining the drug discovery process is required [12].

In the present study, natural products in the functional databases will be screened for best docking score against the selected target. In vitro studies will be conducted with natural product showing best docking score on Triple negative breast cancer cell line. An anticancer drug will be used as a positive control. The cytotoxic effect of the natural product will also be tested in normal cell line. This study will highlight a potential anticancer candidate from a natural source.

6. Research question or hypothesis, aim and objectives……(Max 300 words)

Aims and Objectives

The current study aims to explore novel therapeutic targets for Triple negative breast cancer. The systematic protocol of this study involves integration of bioinformatics and in silico approaches for hypothesis generation. Finally, the research findings of the aforementioned computational procedures will be validated under in vitro conditions.

Objectives

1. To derive gene signatures specific for Triple negative breast cancer
2. Computer aided screening of natural products (derived from microbes, marine algae, plants etc) against selected drug targets.
3. Anticancer activity of selected active component(s) in Triple negative breast cancer cell line (MDA-MB-231 Cells).

7. Research design (type of study)… (Max 300 words)

Research Design

The research design comprises three phases: In Phase 1, Bioinformatic techniques will be used to decipher the disease-specific targets that underpin the pathogenic condition. In phase 2, Selected phytoactives will be screened against the identified targets in computer modelling studies to uncover prospective Triple Negative Breast Cancer target-specific medicines. In vitro investigations will be used to validate the cytotoxicity of practically every nominated medication in Phase 3.

Phase 1: Identification of the Target

Combined analysis of microarray datasets:

The combined analysis helps to find leading information on the differences between TNBC and Non-TNBC in gene expression. The microarray data will be retrieved from the Gene Expression Omnibus (GEO) database (http://www.ncbi.nlm.nih.gov/geo) will be integrated into the current study (Barrett et al., 2013) with keywords "Triple negative Breast Cancer and Breast cancer". We will be selecting only the unique microarray data sets that examined gene expression profiling of Breast cancer which include Non-TNBC and TNBC in human (Yang et al., 2014).

Analyzing the microarray data sets with GEO tool:

Gene Expression Omnibus is a worldwide open storehouse that libraries and easily dispenses of high throughput purposeful genomics data, microarray data, and next-generation sequencing data to the research community. We will be using Gene Expression Omnibus to compare TNBC and Non-TNBC microarray datasets in direction to categorize genes that are differentially expressed across experimental conditions.

Subsequently, the microarray raw data will be translated to expressional data using GEO2R. Significant Differentially expressed genes between TNBC and Non-TNBC will be identified. The threshold for selecting the Differentially expressed genes will be set at adjusted P-value <0.05 and Log FC>2.

Construction and visualization of protein–protein interaction (PPI) network:

PPI cascades which are considered as crucial regulators of cellular biological processes will be captured to identify Differentially expressed genes between each group.

Gene set enrichment analysis of cross-talk genes

GO and KEGG enrichment analyses will be performed using Cytoscape software with the ClueGO-V2.1.7-plugin to investigate the involvement of cross-talk genes in cellular processes, biological processes, molecular functions, and pathways.

Phase-2: Computational simulation studies to explore potential drugs

Molecular docking to unveil the interaction between selected TNBC target and drugs

MMGBSA analysis

MMGBSA analysis will be performed to estimate the binding free energies (ΔGbind) of the best docked compounds. The compounds with high binding energies will be shortlisted for further evaluation

Molecular dynamic simulation

The shortlisted compounds post-MMGBSA analysis will be further subjected to Molecular Dynamics (MD) simulation studies

Phase-3: In vitro experimental validation to confirm cytotoxicity of identified drug

MTT assay

The drug which was shortlisted via aforementioned virtual techniques will be tested experimentally for its cytotoxic potential by carrying out MTT assay on Triple negative breast cancer cell line.

SRB Assay

The sulforhodamine B assay remains one of the most widely used method for in vitro cytotoxicity.

8. Study population and sampling (If applicable) –

NA

9. Data collection methods and instruments (Max 300 words)

- Computational work station for screening of natural products
- Fluorescent microscopy
- UV spectrophotometer

10. Data analysis methods – if applicable statistical planning must be fully addressed, or the candidate should provide evidence that statistics are not required

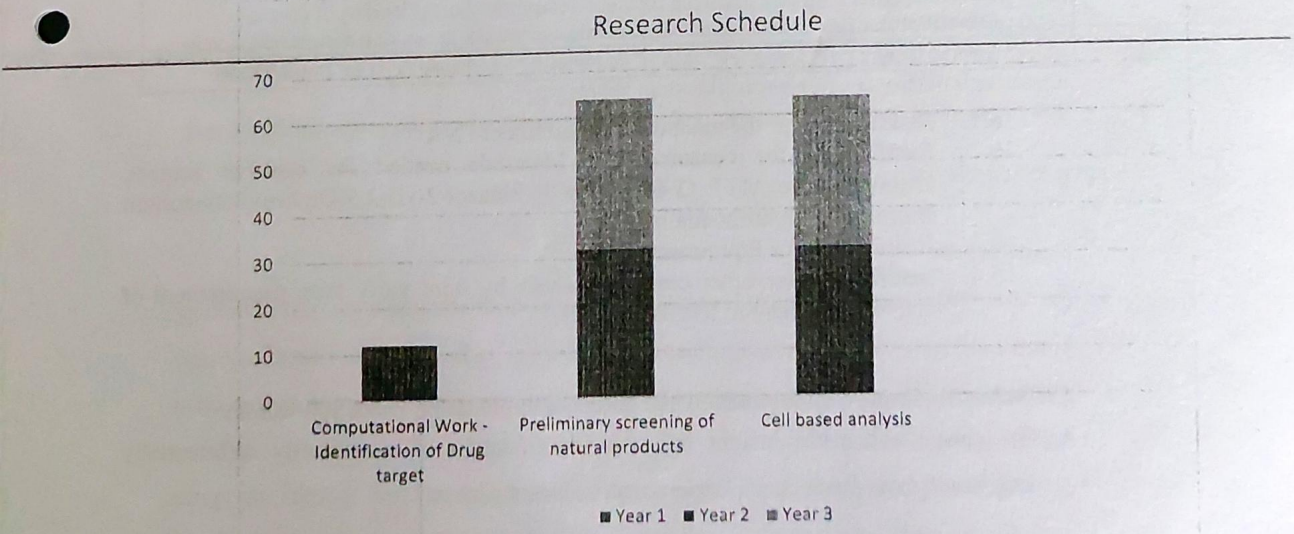
ANOVA analysis, Students t test, DMRT test will be used in the study wherever applicable

11. Mechanisms to assure the quality of the study – e.g. control of bias, safe storage of data….(Max 300 words)

Each methodology will be studied with positive and negative controls. A standard anticancer drug will be used as positive control against which group treated with natural product will be compared. The efficacy of the natural product will also be tested against normal noncancerous cell line.

For combined analysis of microarray datasets, we will select only the unique microarray data sets that examined gene expression profiling of Breast cancer which include Non-TNBC and TNBC in human.

12. Research Schedule -Bar chart for completion of the project



13. Participants in the study – all people involved in the study, and the role they play, should be identified.*

Not Applicable

14. Ethical considerations - (Max 300 words)

Not Applicable

15. Environmental Issues (Max 300 words)

Not Applicable

16. Resources required for the study, including budget (Personnel, Consumables, Equipment, Travel, Subcontracting, Provisions, Licensing fees, other).....

Sl. No	Item	BUDGET			Amount (In Rupees)
		1st Year	2nd Year	3rd Year	Total
1.	Equipment	Nil	Nil	Nil	Nil
2.	Consumables				200000
3.	Research Assistant	-	-	-	-
4.	Travel	10000	15000	15000	40000
5.	Other costs	5000	10000	10000	25000
6.	Analysis cost	-	40000	60000	100000
7.	Procuring Active constituent	-	100000		100000
	Grand total				465000

16.1. Justification for the manpower requirement : NA

16.2. Justification for consumable : Materials needed for research project, chemicals like MTT (3-(4,5-Dimethylthiazol-2-yl)-2,5-Diphenyltetrazolium Bromide), Sulphorhodamine B

16.3. Justification for Equipment : NA

16.4. Justification for other costs : Analysis by third party labs, procurement of active constituent to test its efficacy.

17. Scientific Impact, dissemination and potential exploitation (Max 300 words)

- To gain mechanistic insight into the identification of consistently differentially expressed gene products in Triple negative breast cancer.

- The consistently differentially expressed gene products identified definitely has clinical significance and can beeffectively exploited in targeted therapy for Triple negative Breast cancer.
- Computer aided screening of natural products (derived from microbes, marine algae, plants etc). will identify a novel therapeutic target for Triple negative cancer cell line.
- Current study will highlight a potential anticancer drug candidate for Triple negative breast cancer.

18. References……(Max 50)

1. Yin L, Duan J-J, Bian X-W, Yu S-c. Triple-negative breast cancer molecular subtyping and treatment progress. Breast Cancer Research. 2020;22:61.
2. Reddy SM, Barcenas CH, Sinha AK, Hsu L, Moulder SL, Tripathy D, et al. Long-term survival outcomes of triple-receptor negative breast cancer survivors who are disease free at 5 years and relationship with low hormone receptor positivity. British journal of cancer. 2018;118:17-23.
3. Brogi S, Ramalho TC, Kuca K, Medina-Franco JL, Valko M. Editorial: In silico Methods for Drug Design and Discovery. Frontiers in Chemistry. 2020;8.
4. Desai AG, Qazi GN, Ganju RK, El-Tamer M, Singh J, Saxena AK, et al. Medicinal plants and cancer chemoprevention. Current drug metabolism. 2008;9:581-91.
5. Yin SY, Wei WC, Jian FY, Yang NS. Therapeutic applications of herbal medicines for cancer patients. Evid Based Complement Alternat Med. 2013;2013:302426.
6. Damaskos C, Garmpi A, Nikolettos K, Vavourakis M, Diamantis E, Patsouras A, et al. Triple-Negative Breast Cancer: The Progress of Targeted Therapies and Future Tendencies. Anticancer Res. 2019;39:5285-96.
7. Çokkinides V, Albano J, Samuels A, Ward M, Thum J. American cancer society: Cancer facts and figures. Atlanta: American Cancer Society. 2005.
8. Brenton JD, Carey LA, Ahmed AA, Caldas C. Molecular classification and molecular forecasting of breast cancer: ready for clinical application? J Clin Oncol. 2005;23:7350-60.
9. Ismail-Khan R, Bui M. A Review of Triple-Negative Breast Cancer. Cancer control : journal of the Moffitt Cancer Center. 2010;17:173-6.
10. Liu W, Yang B, Yang L, Kaur J, Jessop C, Fadhil R, et al. Therapeutic Effects of Ten Commonly Used Chinese Herbs and Their Bioactive Compounds on Cancers. Evidence-Based Complementary and Alternative Medicine. 2019;2019:6057837.
11. Leonard J, Namasivayam V, Poongavanam V, Kannan S. In Silico Approaches for Drug Discovery and Development. In: editor^editors, editor;2017.p.3-74.
12. Ekins S, Mestres J, Testa B. In silico pharmacology for drug discovery: methods for virtual ligand screening and profiling. British journal of pharmacology. 2007;152:9-20.

19. Appendices (copy of questionnaire, consent forms, etc.)

NA

*Note 1: ***All proposals are subject to initial screening. If a proposal passes initial screening it is formally accepted as an application and will enter a second screening stage comprising of a high powered committee.***

*Note 2: Submit the completed form (both hard and soft copy) to the Principal, RCASC

Endorsement from the Head of Department*
(To be given on letter head)

Project Title: In silico and In vitro screening of natural products for Triple Negative Breast Cancer

1. Certified that the Department welcomes participation of **Dr. Vidya M, RCASC** as the Principal Investigator and **Dr. Krishna Murthy, RIT** as the Principal Co-Investigator for the Project and that in the unforeseen event of discontinuance by the Principal Investigator, the Principal Co-Investigator will assume the responsibility of the fruitful completion of the Project.

Name and Signature of Head of Department

Date: 06.12.2021
Place: Bangalore

Certificate from the Investigator

Project Title: In silico and In vitro screening of natural products for Triple Negative Breast Cancer

1. I/ We agree to abide by the terms and conditions of the research grant.

2. I/ We did not submit the Project proposal elsewhere for financial support.
3. I/ We have explored and ensured that equipment and basic facilities will actually be available as and when required for the purpose of the Projects.
4. I/ We undertake that on permanent equipment will be made available to other users during spare time.

Date: 06.12.2021
Place: Bangalore.

Dr. M. VIDYA
Name and signature of Principal Investigator

Date: 06.12.2021
Place: Bangalore

Name and signature of Co- Investigator
Dr. T P Krishna Murthy.

The above project is Approved / Not Approved

Comments:

Signatures of the committee Members

Signature of the Principal

1.

2.

3.

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College of Arts, Science & Commerce

18. 09. 2021

To,
The Principal,
MSRCASC,
Bengaluru.

From,
Dr. Nirmala Devi. D,
Department of Microbiology,
MSRCASC,
Bengaluru.

Through Proper Channel

Sub: Regarding the change of Co- Investigator of Seed money project.

Dear Madam,

The Co-Investigator of the seed money project entitled "Control and detoxification of Mycotoxins in food and feed- A biological approach", Dr. Manjunatha A. S has resigned from the college. In this regard, I would like to include Mrs. Soumya S. Shanbhag, Assistant Professor, Department of Microbiology as the Co-Investigator to carry out the research project. I request you to kindly approve the same and do the needful.

Thanking You.

Yours Sincerely,

Dr. Nirmala Devi. D 18/9/21

Mrs. Soumya. S. Shanbhag 18/9/2021

HOD 18/9/2021.

May be Permitted to add.

RESEARCH AND DEVELOPMENT FUND

EVALUATION CRITERIA

Name of the principal investigator	Dr. Vibha Vinayakumar Bhat
Department	Chemistry
Affiliation	MSRCASC
Name of the Co-Principal Investigator	Mrs. Ramya Kumari B.S.
Department	Biochemistry
Affiliation	MSRCASC

Title of the Proposal

Synthesis of fumaranilide derivatives of Lanthanum(III) complexes and their screening for AChE and BuChE inhibition activities.

Excellent 5; Very Good 4; Good 3; Fair; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1.	Introduction and Rationale (Background, Problem statement and aims/ objectives)		4				4
2.	Literature Review (Relevance, recent developments, and organization of issues, etc)			3			3
3.	Research Methodology (appropriateness of methods and experimental design, etc)		4				4
4.	Feasibility of study and preliminary results (suitability to scope, aims, resources, outcomes and practicality)			3			3
5.	Expertise of PI/ Co-PI (expertise, publications and networking)			3			3

6.	Impact on Socio-Economic issues		4				4
7.	Budget		4				4
8.	Overall performance (presentation skills, pro activeness and confidence in Q & A session etc)		4				4
			Total				29

Overall Decision	Satisfactory	Satisfactory*	Unsatisfactory
	✓	With minor amendments/ comments to improve	(less than 20 marks)

Signature of Panel Member: B.M.Nagathana

Name of the Panel Member : Dr B.M.Nagathana Date: 23.03.2021

Title of the project:

Comments:

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nirf (National Institutional Ranking Framework, Ministry of Education, Govt of India)
Ranked 62nd in NIRF India Ranking by MHRD, New Delhi
DBT Star College Scheme

RESEARCH AND DEVELOPMENT FUND

EVALUATION CRITERIA

Name of the principal investigator	Dr. Vibha Vinayakumar Bhat
Department	Chemistry
Affiliation	MSRCASC
Name of the Co-Principal Investigator	Mrs. Ramya Kumari B.S.
Department	Biochemistry
Affiliation	MSRCASC.
Title of the Proposal	
Synthesis of fumaramide derivatives of Lanthanum(III) complexes and their screening for AChE and BuChE inhibition activities	

Excellent 5; Very Good 4; Good 3; Fair; Poor 1

Item	*Evaluation Criteria*	*5*	*4*	*3*	*2*	*1*	***Actual Marks***
1.	*Introduction and Rationale (Background, Problem statement and aims/ objectives)*						5
2.	*Literature Review (Relevance, recent developments, and organization of issues, etc)*						4
3.	*Research Methodology (appropriateness of methods and experimental design, etc)*						5
4.	*Feasibility of study and preliminary results (suitability to scope, aims, resources, outcomes and practicality)*						5
5.	*Expertise of PI/ Co-PI (expertise, publications and networking)*						5

6.	Impact on Socio-Economic issues						4
7.	Budget						4
8.	Overall performance (presentation skills, pro activeness and confidence in Q & A session etc)						5
				Total			37

Overall Decision	**Satisfactory** ✓	**Satisfactory*** *With minor amendments/ comments to improve*	**Unsatisfactory** *(less than 20 marks)*

Signature of Panel Member:

Name of the Panel Member : Dr. Chandraprabha Date: 23/3/22

Title of the project:

Comments:

The time line of the project work should be revised..

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nirf (National Institutional Ranking Framework, Ministry of Education, Govt of India)
Ranked 62 in NIRF India Ranking by MHRD, New Delhi
DBT Star College Scheme

RESEARCH AND DEVELOPMENT FUND

EVALUATION CRITERIA

Name of the principal investigator	Dr. Shashidhar Bharadwaj. S.
Department	Chemistry
Affiliation	MSRCASC.
Name of the Co-Principal Investigator	Dr. Samrat. K.
Department	Biotechnology
Affiliation	MSRIT

Title of the Proposal

Design, Synthesis & Evaluation of Quinoline hybrids as Novel Inhibitors against the P. Falciparum Dihydrofolate Reductase (PfDhfr) & Possible promising Antimalarial: Investigation of Antimalarial activity

Excellent 5; Very Good 4; Good 3; Fair; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1.	Introduction and Rationale (Background, Problem statement and aims/ objectives)				2		2
2.	Literature Review (Relevance, recent developments, and organization of issues, etc)			3			3
3.	Research Methodology (appropriateness of methods and experimental design, etc)			3			3
4.	Feasibility of study and preliminary results (suitability to scope, aims, resources, outcomes and practicality)			3			3
5.	Expertise of PI/ Co-PI (expertise, publications and networking)			3			3

6.	Impact on Socio-Economic issues		4			4
7.	Budget		2		2	2
8.	Overall performance (presentation skills, pro activeness and confidence in Q & A session etc)		4			4
			Total			24

Overall Decision	Satisfactory	Satisfactory*	Unsatisfactory
	✓	With minor amendments/ comments to improve	(less than 20 marks)

Signature of Panel Member:

Name of the Panel Member : Dr B.M - Nagabhushana Date: 23-03-2022

Title of the project:

Comments:

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RESEARCH AND DEVELOPMENT FUND

EVALUATION CRITERIA

Name of the principal investigator	Dr. Shashidhar Bharadwaj. S.
Department	Chemistry
Affiliation	MSRCASC
Name of the Co-Principal Investigator	Dr. Samrat K.
Department	Biotechnology
Affiliation	MSRIT

Title of the Proposal

Design, Synthesis & Evaluation of Quinoline hybrids as Novel Inhibitors against the P. Falciparum Dihydrofolate Reductase (PfDHFR) as Possible promising Antimalarial : Investigation of Antimalarial Activity

Excellent 5; Very Good 4; Good 3; Fair; Poor 1

Item	*Evaluation Criteria*	*5*	*4*	*3*	*2*	*1*	*Actual Marks*
1.	*Introduction and Rationale (Background, Problem statement and aims/ objectives)*						5
2.	*Literature Review (Relevance, recent developments, and organization of issues, etc)*						4
3.	*Research Methodology (appropriateness of methods and experimental design, etc)*						3
4.	*Feasibility of study and preliminary results (suitability to scope, aims, resources, outcomes and practicality)*						4
5.	*Expertise of PI/ Co-PI (expertise, publications and networking)*						4

6.	Impact on Socio-Economic issues						3
7.	Budget						3
8.	Overall performance (presentation skills, pro activeness and confidence in Q & A session etc)						4
				Total			30

Overall Decision	**Satisfactory**	**Satisfactory*** ✓ **With minor amendments/ comments to improve**	**Unsatisfactory** **(less than 20 marks)**

Signature of Panel Member:

Name of the Panel Member : Dr. Chandraprabha Date: 23/3/22

Title of the project:

Comments:

Budget can be revised and available infrastructure from other institutions can be utilized.

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Recognized by UGC under 2f & 12B of UGC act 1956
(National Institutional Ranking Framework, Ministry of Education, Govt of India)
Ranked 62 in MBA, Ranked by MHRD, New Delhi
PET State College - Ranked

RESEARCH AND DEVELOPMENT FUND

EVALUATION CRITERIA

Name of the principal investigator	Mr. BHARATH. K. DEVENDRA
Department	CHEMISTRY.
Affiliation	MSRCASC.
Name of the Co-Principal Investigator	Dr. R. HARI KRISHNA
Department	CHEMISTRY
Affiliation	MSRIT

Title of the Proposal

Advanced Strategies for hydrogen Generation and Dye Degradation Applications using Noble Metal catalysts

Excellent 5; Very Good 4; Good 3; Fair; Poor 1

Item	*Evaluation Criteria*	*5*	*4*	*3*	*2*	*1*	*Actual Marks*
1.	*Introduction and Rationale (Background, Problem statement and aims/ objectives)*		4				
2.	*Literature Review (Relevance, recent developments, and organization of issues, etc)*				2		
3.	*Research Methodology (appropriateness of methods and experimental design, etc)*		4				
4.	*Feasibility of study and preliminary results (suitability to scope, aims, resources, outcomes and practicality)*			3			
5.	*Expertise of PI/ Co-PI (expertise, publications and networking)*		4				

6.	Impact on Socio-Economic issues		4			
7.	Buaget			3		
8.	Overall performance (presentation skills, pro activeness and confidence in Q & A session etc)		4			
			Total			28

Overall Decision	Satisfactory	Satisfactory*	Unsatisfactory
	✓	With minor amendments/ comments to improve	(less than 20 marks)

Signature of Panel Member: Dr Nagabhushana

Name of the Panel Member : Dr B.M - Nagabhushana Date: 23.03.2022

Title of the project:

Comments:

RAMAIAH

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M S Ramaiah College of Arts, Science and Commerce

nirf

RESEARCH AND DEVELOPMENT FUND

EVALUATION CRITERIA

Name of the principal investigator	Mr. BHARATH K. DEVENDRA
Department	CHEMISTRY
Affiliation	MSRCASC
Name of the Co-Principal Investigator	Dr. R. HARI KRISHNA
Department	CHEMISTRY
Affiliation	MSRIT

Title of the Proposal

Advanced strategies for hydrogen generation and Dye degradation applications using noble metal catalysts

Excellent 5; Very Good 4; Good 3; Fair; Poor 1

Item	Evaluation Criteria	5	4	3	2	1	Actual Marks
1.	Introduction and Rationale (Background, Problem statement and aims/ objectives)						5
2.	Literature Review (Relevance, recent developments, and organization of issues, etc)						5
3.	Research Methodology (appropriateness of methods and experimental design, etc)						4
4.	Feasibility of study and preliminary results (suitability to scope, aims, resources, outcomes and practicality)						3
5.	Expertise of PI/ Co-PI (expertise, publications and networking)						5

6.	*Impact on Socio-Economic issues*						4
7.	*Budget*						4
8.	*Overall performance (presentation skills, pro activeness and confidence in Q & A session etc)*						5
				Total			35

Overall Decision	***Satisfactory***	***Satisfactory**** ***With minor amendments/ comments to improve***	***Unsatisfactory*** ***(less than 20 marks)***

Signature of Panel Member:

Name of the Panel Member : Dr. Chandraprabha Date: 23/3/22

Title of the project:

Comments:

The project can focus more on hydrogen generation and corrosion inhibition applications which would be economically feasible while considering use of noble metals.

RAMAIAH
College of Arts, Science & Commerce

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M S Ramaiah College of Arts, Science and Commerce
Re-accredited 'A' by NAAC, Permanently Affiliated to Bengaluru City University,
Approved by Government of Karnataka, Approved by AICTE, New Delhi
Recognized by UGC under 2f & 12B of UGC act 1956
nirf (National Institutional Ranking Framework, Ministry of Education, Govt of India)
Ranked 62nd in NIRF India Ranking by MHRD, New Delhi
DBT Star College Scheme

RESEARCH AND DEVELOPMENT FUND

EVALUATION CRITERIA

Name of the principal investigator	Dr. Hasreesh Kumar. P.
Department	chemistry.
Affiliation	MSRCASC
Name of the Co-Principal Investigator	S. G. Prasanna kumar.
Department	chemistry.
Affiliation	MSRCASC.

Title of the Proposal

Synthesis of analogues of molnupiravir and their anti-covid-19 activity.

Excellent 5; Very Good 4; Good 3; Fair; Poor 1

Item	*Evaluation Criteria*	*5*	*4*	*3*	*2*	*1*	*Actual Marks*
1.	*Introduction and Rationale (Background, Problem statement and aims/ objectives)*			3			
2.	*Literature Review (Relevance, recent developments, and organization of issues, etc)*			3			
3.	*Research Methodology (appropriateness of methods and experimental design, etc)*		2				
4.	*Feasibility of study and preliminary results (suitability to scope, aims, resources, outcomes and practicality)*			3			
5.	*Expertise of PI/ Co-PI (expertise, publications and networking)*		2				

6.	Impact on Socio-Economic issues			3			
7.	Budget			3			
8.	Overall performance (presentation skills, pro activeness and confidence in Q & A session etc)		2				
			Total				22

Overall Decision	Satisfactory	Satisfactory*	Unsatisfactory
	✓	With minor amendments/ comments to improve	(less than 20 marks)

Signature of Panel Member:

Name of the Panel Member : Dr B. M.

Date: 23.03.2022

Title of the project:

Comments:

RESEARCH AND DEVELOPMENT FUND

EVALUATION CRITERIA

Name of the principal investigator	Dr. Hareesh kumar P.
Department	chemistry.
Affiliation	MSRCASC
Name of the Co-Principal Investigator	S. G. Prasanna kumar.
Department	chemistry.
Affiliation	MSRCASC.

Title of the Proposal

"Synthesis of analogues of Methuposavir and their Anti-Covid-19 activity.

Excellent 5; Very Good 4; Good 3; Fair; Poor 1

Item	*Evaluation Criteria*	*5*	*4*	*3*	*2*	*1*	*Actual Marks*
1.	*Introduction and Rationale (Background, Problem statement and aims/ objectives)*						5
2.	*Literature Review (Relevance, recent developments, and organization of issues, etc)*						5
3.	*Research Methodology (appropriateness of methods and experimental design, etc)*						5
4.	*Feasibility of study and preliminary results (suitability to scope, aims, resources, outcomes and practicality)*						5
5.	*Expertise of PI/ Co-PI (expertise, publications and networking)*						5

6.	Impact on Socio-Economic issues						4
7.	Budget						4
8.	Overall performance (presentation skills, pro activeness and confidence in Q & A session etc)						5
			Total				38

Overall Decision	Satisfactory	Satisfactory* With minor amendments/ comments to improve	Unsatisfactory (less than 20 marks)

Signature of Panel Member:

Name of the Panel Member : Dr. Chandra Prabha Date: 23/3/22

Title of the project:

Comments:

Good proposal.

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RESEARCH AND DEVELOPMENT FUND

EVALUATION CRITERIA

Name of the principal investigator	
Department	
Affiliation	
Name of the Co-Principal Investigator	
Department	
Affiliation	
Title of the Proposal	

Excellent 5; Very Good 4; Good 3; Fair; Poor 1

Item	*Evaluation Criteria*	*5*	*4*	*3*	*2*	*1*	*Actual Marks*
1.	*Introduction and Rationale (Background, Problem statement and aims/ objectives)*						
2.	*Literature Review (Relevance, recent developments, and organization of issues, etc)*						
3.	*Research Methodology (appropriateness of methods and experimental design, etc)*						
4.	*Feasibility of study and preliminary results (suitability to scope, aims, resources, outcomes and practicality)*						
5.	*Expertise of PI/ Co-PI (expertise, publications and networking)*						

6.	Impact on Socio-Economic issues						
7.	Budget						
8.	Overall performance (presentation skills, pro activeness and confidence in Q & A session etc)						
				Total			

Overall Decision	***Satisfactory***	***Satisfactory**** ***With minor amendments/ comments to improve***	***Unsatisfactory*** ***(less than 20 marks)***

Signature of Panel Member:

Name of the Panel Member : Date:

Title of the project:

Comments: