



सत्यमेव जयते

Government of West Bengal  
Office of the Principal

# GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY

At.-Telipukur : P.O.- Tilaboni Mahisamura : P.S.- Keshiary

Dist- Paschim Medinipur : PIN-721135

www.ggdckeshiary.ac.in

## Criterion 3: Research, Innovations and Extensions

### 3.1. Resource Mobilization in Research


3.1.1 Grants received from Government and non-governmental agencies for research projects / endowments in the institution during the last five years (INR in Lakhs)

#### Summary of the Grant Received in Last Five Years (INR in Lacs)

2018-19	2019-20	2020-21	2021-22	2022-23	Total
-	2.75	2.71	-	2.10	7.56

#### Contents:

1. Details of the Grant Received in Last Five Years (INR in Lacs)
2. Year Wise Sanctioned Orders
3. Year Wise Audited Utilization Certificate(UC) and Statement of Expenditure (SE)
4. Project completion acknowledgement from SERB
5. Project completion Certificate from IIT, Kharagpur
6. Acknowledgement of the SERB, India in the Publications

  
Officer-in-Charge  
Govt. Gen. Degree College  
Keshiary



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## 1. Details of the Grant Received in Last Five Years (INR in Lacs)

Name of the research project/ endowment	Name of the Principal Investigator/ Co- investigator	Department of Principal Investigator	Year of Award	Amount Sanctioned	Duratio n of the project	Name of the Funding Agency	Type (Government/ non- Government)
<b>1<sup>st</sup> Year (2018-19)</b>							
NA	NA	NA	NA	0	NA	NA	NA
<b>2<sup>nd</sup> Year (2019-20)</b>							
A Comprehensive Interpretation on Specific Sequence Binding Selectivity of Designed Fluorescent Organic Molecules and Engineered Nanoclusters in Genomic DNA and Oligonucleotides through Biophysical Study, Computational Calculation and in-vitro Analysis	Soumya Sundar Mati	Chemistry	2019	2,75,000	3 years	SERB, India	Government
<b>3<sup>rd</sup> Year (2020-21)</b>							
A Comprehensive Interpretation on Specific Sequence Binding Selectivity of Designed Fluorescent Organic Molecules and Engineered Nanoclusters in Genomic DNA and Oligonucleotides through Biophysical Study, Computational Calculation and in-vitro Analysis	Soumya Sundar Mati	Chemistry	2021	2,71,000	3 years	SERB, India	Government
<b>4<sup>th</sup> Year (2021-22)</b>							
NA	NA	NA	NA	0	NA	NA	NA
<b>5<sup>th</sup> Year (2022-23)</b>							
A Comprehensive Interpretation on Specific Sequence Binding Selectivity of Designed Fluorescent Organic Molecules and Engineered Nanoclusters in Genomic DNA and Oligonucleotides through Biophysical Study, Computational Calculation and in-vitro Analysis	Soumya Sundar Mati	Chemistry	2022	2,10,000	3 years	SERB, India	Government

  
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**2. Year Wise Sanctioned Orders**

**2019**

FILE NO. TAR/2019/000030  
**SCIENCE & ENGINEERING RESEARCH BOARD(SERB)**  
(A statutory body of the Department of Science & Technology, Government of India)  
S & SA, Lower Ground Floor  
Vasant Square Mall  
Plot No. A, Community Centre  
Sector-B, Pocket-5, Vasant Kunj  
New Delhi-110070  
Dated: 17-Dec-2019

**ORDER**  
Subject: Financial Sanction under Teachers Associationship for Research Excellence (TARE) to Dr. SOUMYA SUNDAR MATI, GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, VIII-Telipukur, P.O.-Tilaboni Mahisamura, P.S.-Keshiary, Paschim Medinipur, Pin-721135, Midnapore, West Bengal-721135; under the mentorship of Prof. Nilmoni Sarkar, at INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR Kharagpur, West Bengal 721302 - 721302. Release of 1st grant.

Sanction of Science and Engineering Research Board (SERB) is hereby accorded to the above mentioned grant at a total cost of Rs. 18,30,000/- (Rs. Eighteen Lakh Thirty Thousand Only) for a duration of 36 months. The date of start of the project will be 01 November, 2019. The terms of expenditure for which the total allocation of Rs. 18,30,000/- has been approved are given below:  
The following budget is proposed for  
**GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, VIII-Telipukur, P.O.-Tilaboni Mahisamura, P.S.-Keshiary, Paschim Medinipur, Pin-721135, Midnapore, West Bengal-721135 (Parent)**

Sr. No.	Budget Head	Amount
1.	Fellowship	Rs. 0 (@0/- per month (consolidated))
2.	Research Grant	Rs. 2,50,000/- per annum
3.	Overheads	Rs. 25,000/- per annum

**INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR Kharagpur, West Bengal 721302 - 721302 (Host)**

Sr. No.	Budget Head	Amount
1.	Fellowship	Rs. 60,000 (on completion of 90 days mandatory attendance in the host institute every year)
2.	Research Grant	Rs. 2,50,000/- per annum
3.	Overheads	Rs. 25,000/- per annum

2. Sanction of the SERB is also accorded to the payment of Rs. 3,70,000/- (Rupees Two Lakh Seventy Five Thousand only) to GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, VIII-Telipukur, P.O.-Tilaboni Mahisamura, P.S.-Keshiary, Paschim Medinipur, Pin-721135. Rs. 3,38,000/- (Rupees Three Lakh Thirty Eight Thousand only) to INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR Kharagpur, West Bengal 721302 - 721302, being the first instalment of the grant for the year 2019-2020 for implementation of the said research project.

3. The expenditure involved is debitable to Fund for Science & Engineering Research (FSER)  
This release is being made under Teachers Associationship For Research Excellence (TARE) (Physical Chemistry)

4. The Sanction has been issued with the approval of the competent authority vide Diary No. SERB/T/7098/2019-2020 dated 17 December, 2019

5. Sanction of the grant is subject to the conditions as detailed in Terms & Conditions available at website ([www.serb.gov.in](http://www.serb.gov.in))

6. Overhead expenses are meant for the host Institute towards the cost for providing infrastructural facilities and general administrative support etc. including benefits to the staff employed in the project.

7. As per rule 211 of GFR, the accounts of project shall be open to inspection by sanctioning authority/audit whenever the institute is called upon to do so.

8. The release amount of Rs. 2,76,000/- (Rupees Two Lakh Seventy Six Thousand only) will be drawn by the Under Secretary of the SERB and will be disbursed by means of RTGS transaction as per their Bank details given below:  
**GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, VIII-Telipukur, P.O.-Tilaboni Mahisamura, P.S.-Keshiary, paschim medinipur, pin-721135, Midnapore, West bengal-721135 (Parent Institute):**

PFMS Unique Code	
Account Name	CHEMISTRY, SERB-TARE, GDDCK
Account Number	38909144917
Bank Name & Branch	STATE BANK OF INDIA KESHIARY, VILL + PO - KESHIARY, PASCHIM MEDINIPUR WEST BENGAL 721135
IFSC/RTGS Code	SBIN0012439
Email address of PI	soumyamati@gmail.com
Email id of A/C Holder	principalkeshiarygovcollege@gmail.com
Email address of concerned officer	ms_tare@serbonline.in

The release amount of Rs. 3,38,000/- (Rupees Three Lakh Thirty Eight Thousand only) will be drawn by the Under Secretary of the SERB and will be disbursed by means of RTGS transaction as per their Bank details given below:  
**INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR Kharagpur, West Bengal 721302 - 721302 (Host Institute):**

PFMS Unique Code	ITKGP
Account Name	IT Research Scheme
Account Number	9556201000790
Bank Name & Branch	SYNDICATE BANK SRUC-IT Kharagpur Branch, SRUC-IT KHARAGPUR - 721302, WB
IFSC/RTGS Code	SYNB0009556
Email address of PI	soumyamati@gmail.com
Email id of A/C Holder	sumit@adm.itkgp.ernet.in
Email address of concerned officer	ms_tare@serbonline.in

9. Both the institutes will furnish Utilization certificate(UCs) financial year wise to the SERB and an audited statement of accounts pertaining to the grant immediately after the end of each financial year.

10. The institute will maintain separate audited accounts for the fellowship. A part or whole of the grant must be kept in an interest earning bank account which is to be reported to SERB. The interest thus earned will be treated as credit to the institute to be adjusted towards further instalment of the grant.

11. The File no. TAR/2019/000030 may also be mentioned in all research communications arising from the above project with due acknowledgement of SERB.

12. As this is the first grant for the fellowship, no previous U/C is required.

13. The institute will refund any unspent balance to SERB by means of a Demand Draft favoring "FUND FOR SCIENCE AND ENGINEERING RESEARCH" payable at New Delhi.

14. The organization/institute/university should ensure that the technical support/financial assistance provided to them by the Science & Engineering Research Board, a statutory body of the Department of Science & Technology (DST), Government of India should invariably be highlighted/acknowledged in their media releases as well as in bold letters in the opening paragraphs of their Annual Report.

15. In addition, the investigator/host institute must also acknowledge the support provided to them in all publications, patents and any other output emanating out of the project/program funded by the Science & Engineering Research Board, a statutory body of Department of Science & Technology (DST), Government of India.

(Dr. T. Thangarajou)  
Scientist E  
ms\_tare@serbonline.in

To,  
Under Secretary  
SERB, New Delhi  
Copy forwarded for information and necessary action to :-

1.	The Principal Director of Audit, A.C.R. Building, IIIrd Floor I.P. Estate, Delhi-110002
2.	Sanction Folder, SERB, New Delhi.
3.	File Copy
4.	(i) Dr. SOUMYA SUNDAR MATI Department of Chemistry GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, VIII-Telipukur, P.O.-Tilaboni Mahisamura, P.S.-Keshiary, paschim medinipur, pin-721135, Midnapore, West bengal-721135 Email: soumyamati@gmail.com Mobile: 9869797976 (ii) Prof. Nilmoni Sarkar INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR Kharagpur, West Bengal 721302 - 721302 (Start date of the project may be intimated by name to the undersigned. For guidance, terms & Conditions etc. Please visit <a href="http://www.serb.gov.in">www.serb.gov.in</a> .)
5.	(i) Officer-in-Charge, GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, VIII-Telipukur, P.O.-Tilaboni Mahisamura, P.S.-Keshiary, Paschim Medinipur, PIN - 721135 (ii) DEPUTY REGISTRAR, SRUC IT KHARAGPUR INDIAN INSTITUTE OF TECHNOLOGY, KHARAGPUR Kharagpur, West Bengal 721302 - 721302 (Receipt of Grant may be intimated by name to the undersigned)

(Dr. T. Thangarajou)  
Scientist E  
ms\_tare@serbonline.in

*Thangarajou*  
Officer-in-Charge  
Govt. Gen. Degree College  
Keshiary



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# Government of West Bengal Office of the Principal GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY

At.-Telipukur : P.O.- Tilaboni Mahisamura : P.S.- Keshiary  
Dist- Paschim Medinipur : PIN-721135  
www.ggdckeshiary.ac.in

2021

FILE NO. TAR/2019/000030  
SCIENCE & ENGINEERING RESEARCH BOARD (SERB)  
(a statutory body of the Department of Science & Technology, Government of India)

S & SA, Lower Ground Floor  
Vasant Square Mall  
Plot No. A, Community Centre  
Sector- B, Pocket-5, Vasant Kunj  
New Delhi-110070  
Dated: 19-Mar-2021

**ORDER**

Subject: Research project entitled "A Comprehensive Interpretation on Specific Sequence Binding Selectivity of Designed Fluorescent Organic Molecules and Engineered Nanostructures in Genomic DNA and Oligonucleotides through Biophysical Study, Computational Calculation and in-vitro Analysis" under the guidance of Dr. **SOUMYA SUNDAR MATHI**, Department of Chemistry, GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, Vill Telipukur, P.O. Tilaboni Mahisamura, P.S. Keshiary, Paschim Medinipur, PIN: 721135, West Bengal - 721135, under the mentorship of Prof. Nishmoni Sarkar (Indian Institute of Technology Kharagpur, Kharagpur, West Bengal - 721302) - Release of 2nd grant.

- This is in continuation of SERB's sanction order No. "TAR/2019/000030" dated "17 December, 2019" of Science and Engineering Research Board (SERB).
- Sanction of the competent authority is hereby accorded to the payment of a sum of **Rs. 2,71,000/- (Rupees Two Lakh Seventy One Thousand only)** to GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, Vill Telipukur, P.O. Tilaboni Mahisamura, P.S. Keshiary, Paschim Medinipur, PIN: 721135, Rs. 3,33,000/- (Rupees Three Lakh Thirty Three Thousand only) to Indian Institute of Technology Kharagpur Kharagpur, West Bengal - 721302 being the 2nd grant for the financial year 2020-2021 for implementation of the above said project.
- Sanction of the competent authority is also accorded to carry forward of unspent balance of **Rs. 24,807/- (Rupees Two Lakh Sixty Five Thousand One Hundred and Eighty Seven only)** to GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, Vill Telipukur, P.O. Tilaboni Mahisamura, P.S. Keshiary, Paschim Medinipur, PIN: 721135 and **Rs. 29,923/- (Rupees Two Lakh Ninety Seven Thousand Nine Hundred and Thirty Three only)** to Indian Institute of Technology Kharagpur, Kharagpur, West Bengal from FY 2019-2020 to FY 2020-2021 for the same purpose for which it was sanctioned.
- Sanction of the grant is subject to the conditions as detailed in Terms & Conditions available at the website ([www.serb.gov.in](http://www.serb.gov.in)).
- It is certified that provision of GFR 212 relating to Utilization Certificates (UCs) for the funds released under the grant have been satisfied and the UCs is/are enclosed herewith.
- The expenditure involved is debitable to Fund for Science & Engineering Research (FSER) This release is being made under Teachers Associateship For Research Excellence (TARE), (Tare Expert Committee) .
- The Sanction has been issued with the approval of the competent authority vide Diary No. SERB/T/0638/2020-2021 dated 18 March, 2021.
- The release amount of **Rs. 2,71,000/- (Rupees Two Lakh Seventy One Thousand only)** will be drawn by the Under Secretary of the SERB and will be disbursed by means of RTGS transaction as per their bank details given below.

GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, Vill Telipukur, p.o. Tilaboni mahisamura, p.s. - keshiary, paschim medinipur, pin: 721135, Midnapore, West Bengal-721135 (Parent):

PFMS Unique Code	
Account Name	CHEMISTRY, SERB-TARE, GGDCK
Account Number	38909144917
Bank Name & Branch	STATE BANK OF INDIA KESHIARY, VILL + P.O. - KESHIARY : PASCHIM MEDINIPUR WEST BENGAL 721135
IFSC/RTGS Code	SBIN0012439
Email address of PI	soumyamathi@gmail.com
Email id of A/C Holder	principalkeshiarygovtcollege@gmail.com
Email address of concerned officer	ms_tare@serbonline.in

The release amount of **Rs. 3,33,000/- (Rupees Three Lakh Thirty Three Thousand only)** will be drawn by the Under Secretary of the SERB and will be disbursed by means of RTGS transaction as per their Bank details given below:

Indian Institute of Technology Kharagpur Kharagpur, West Bengal - 721302 (Host):

PFMS Unique Code	HTGGP
Account Name	HT Research Scheme
Account Number	95562016000790

Bank Name & Branch	SYNDICATE BANK SRIC-IT Kharagpur Branch :SRIC-IT KHARAGPUR - 721302, WB
IFSC/RTGS Code	SYND0009556
Email address of PI	soumyamathi@gmail.com
Email id of A/C Holder	sumi@adm.iitkgp.ernet.in
Email id of Mentor	Prof. Nishmoni Sarkar

- The institute will maintain separate audited accounts for the project. A part or whole of the grant must be kept in an interest earning bank account which is to be reported to SERB. The interest thus earned will be treated as credit to the institute to be adjusted towards further instalment of the grant.
- As per rule 211 of GFR the accounts of Grantee Institution shall be open to inspection by the sanctioning authority / audit whenever the institute is called upon to do so.
- The institute will furnish to the SERB, Utilization certificate(separate for Recurring & Non-Recurring) and an audited statement of accounts pertaining to the grant, immediately after the end of each financial year.
- After completion of the project unspent balance if any should be returned as Demand Draft drawn in favour of "Fund for Science and Engineering Research" payable at New Delhi.
- The organization/institute/university should ensure that the technical support/financial assistance provided to them by the Science & Engineering Research Board, a statutory body of the Department of Science & Technology (DST), Government of India should invariably be highlighted/acknowledged in their media releases as well as in bold letters in the opening paragraphs of their Annual Report.
- In addition, the investigator/host institute must also acknowledge the support provided to them in all publications, patents and any other output emanating out of the project/program funded by the Science & Engineering Research Board, a statutory body of Department of Science & Technology (DST), Government of India.

(Dr. T Thangarajou)  
Scientist E  
ms\_tare@serbonline.in

To,  
Under Secretary  
SERB, New Delhi

Copy forwarded for information and necessary action to:-

1.	The Principal Director of Audit, A.G.C.R Building, IIIrd Floor I.P. Estate, Delhi-110002
2.	Sanction Folder, SERB, New Delhi.
3.	File Copy
4.	Dr. SOUMYA SUNDAR MATHI Department of Chemistry GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, Vill Telipukur, p.o. Tilaboni Mahisamura, P.S. Keshiary, paschim medinipur, pin: 721135, Midnapore, West Bengal: 721135 Email: soumyamathi@gmail.com Mobile: 91969771976
5.	Officer-in-Charge, GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, Vill Telipukur, P.O.-Tilaboni Mahisamura, P.S. Keshiary, Paschim Medinipur, PIN :721135

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Dist- Paschim Medinipur : PIN-721135  
www.ggdckeshiary.ac.in

2022

FILE NO. TAR/2019/00030  
SCIENCE & ENGINEERING RESEARCH BOARD(SERB)  
(a statutory body of the Department of Science & Technology, government of India)

Science and Engineering Research Board  
3rd & 4th Floor, Block II  
Technology Bhavan, New Mehrauli Road  
New Delhi - 110016

Dated: 29-Jun-2022

**ORDER**

Subject: Research project entitled A Comprehensive Interpretation on Specific Sequence Binding Selectivity of Designed Fluorescent Organic Molecules and Engineered Nanostructures in Genomic DNA and Oligonucleotides through Biophysical Study, Computational Calculation and in-vitro Analysis under the guidance of Dr. SOUMYA SUNDAR MAITI, Department of Chemistry, GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, Vill-telipukur, p.o.-tilaboni mahisamura, p.s.-keshiary, paschim medinipur, pin-721135, Midnapore, West Bengal-721135, under the mentorship of Prof. Nilmoni Sarkar (Indian Institute of Technology Kharagpur Kharagpur, West Bengal - 721302) - Release of 3rd grant.

1. This is in continuation of SERB's sanction order No. "TAR/2019/00030" dated "17 December, 2019" of Science and Engineering Research Board (SERB).

2. Sanction of the competent authority is hereby accorded to the payment of a sum of **Rs. 2,10,000/- (Rupees Two Lakh Ten Thousand only)** to GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, Vill-telipukur, P.O.-Tilaboni Mahisamura, P.S.-Keshiary, Paschim Medinipur, PIN-721135, Rs. 3,00,000/- (Rupees Three Lakh only) to Indian Institute of Technology Kharagpur Kharagpur, West Bengal - 721302 being the 3rd grant for the financial year 2022-2023 for implementation of the above said project.

3. Sanction of the competent authority is also accorded to carry forward of unspent balance of Rs. 8338/- (Rupees Eight Thousand Three Hundred and Thirty Five only) to GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, Vill-telipukur, P.O.-Tilaboni Mahisamura, P.S.-Keshiary, Paschim Medinipur, PIN-721135 and Rs. 2544/- (Rupees Two Thousand Five Hundred and Forty Four only) to Indian Institute of Technology Kharagpur, Kharagpur, West Bengal from FY 2021-2022 to FY 2022-2023 for the same purpose for which it was sanctioned.

4. Sanction of the grant is subject to the conditions as detailed in Terms & Conditions available at the website serb.gov.in).

5. It is certified that provision of GFR 212 relating to Utilization Certificates (UCs) for the funds released under the above sanction have been satisfied and the UC/s is/are enclosed herewith.

6. The expenditure involved is debitable to Fund for Science & Engineering Research (FSER). This release is being made under Teachers Associateship For Research Excellence (TARE). (Tare Expert Committee).

7. The Sanction has been issued with the approval of the competent authority vide Diary No. SERB/F/2219/2022-2023 dated 28 June, 2022.

8. The release amount of **Rs. 2,10,000/- (Rupees Two Lakh Ten Thousand only)** will be drawn by the Under Secretary of the SERB and will be disbursed by means of RTGS transaction as per their Bank details given below:

GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY, Vill-telipukur, p.o.-tilaboni mahisamura, p.s.-keshiary, paschim medinipur, pin : 721135, Midnapore, West Bengal-721135 (Parent):

PFMS Unique Code	ININ0006482
Account Name	CHEMISTRY, SERB-TARE, GDCK
Account Number	38909144917
Bank Name & Branch	STATE BANK OF INDIA KESHIARY, VILL + P.O. - KESHIARY, PASCHIM MEDINIPUR WEST BENGAL 721133
IFSC/RTGS Code	SBIN0012439
Email address of PI	soumyamaiti@gmail.com
Email id of A/C Holder	principalkeshiarygovtcollege@gmail.com
Email address of concerned officer	tareserb1@gmail.com

The release amount of **Rs. 3,00,000/- (Rupees Three Lakh only)** will be drawn by the Under Secretary of the SERB and will be disbursed by means of RTGS transaction as per their Bank details given below:

Indian Institute of Technology Kharagpur Kharagpur, West Bengal - 721302 (Host):

PFMS Unique Code	IITKGP
Account Name	SPONSORED RESEARCH & INDUSTRIAL CONSULTANCY
Account Number	30419154567
Bank Name & Branch	STATE BANK OF INDIA IIT Kharagpur Branch ; IIT KHARAGPUR - 721302, WB
IFSC/RTGS Code	SBIN000202
Email address of PI	soumyamaiti@gmail.com
Email id of A/C Holder	jregrsic@eric.iitkgp.ac.in
Email id of Mentor	Prof. Nilmoni Sarkar

9. The institute will maintain separate audited accounts for the project. A part or whole of the grant must be kept in an interest earning bank account which is to be reported to SERB. The interest thus earned will be treated as credit to the institute to be adjusted towards further installment of the grant.

10. As per rule 211 of GFR the accounts of Grantee Institution shall be open to inspection by the sanctioning authority / audit whenever the institute is called upon to do so.

11. The institute will furnish to the SERB, Utilization certificate (separate for Recurring & Non- Recurring) and an audited statement of accounts pertaining to the grant immediately after the end of each financial year.

12. After completion of the project unspent balance if any should be returned as Demand Draft drawn in favour of "Indian Institute of Technology Kharagpur for Science and Engineering Research" payable at New Delhi.

13. The organization/institute/university should ensure that the technical support/financial assistance provided to them by the Science & Engineering Research Board, a statutory body of the Department of Science & Technology, Government of India should invariably be highlighted/acknowledged in their media releases as well as in the opening paragraphs of their Annual Report.

14. In addition, the investigator/host institute must also acknowledge the support provided to them in all publications, patents and any other output emanating out of the project/program funded by the Science & Engineering Research Board, a statutory body of Department of Science & Technology (DST), Government of India.

(Dr. Arvind Chaudhary)  
Scientist D  
tareserb1@gmail.com

To,  
Under Secretary  
SERB, New Delhi

Copy forwarded for information and necessary action to:-

1.	The Principal Director of Audit, A.G.C.R Building, 11rd Floor I.P. Estate, Delhi-110002
2.	Sanction Folder, SERB, New Delhi.
3.	File Copy

*Arvind Chaudhary*  
Officer-in-Charge  
Govt. Gen. Degree College  
Keshiary



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**Government of West Bengal  
Office of the Principal  
GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY  
At.-Telipukur : P.O.- Tilaboni Mahisamura : P.S.- Keshiary  
Dist- Paschim Medinipur : PIN-721135  
www.ggdckeshiary.ac.in**

**3. Year Wise Audited Utilization Certificate(UC) and Statement of Expenditure(SE)**

**2019-20**

GFR 12 - A  
[[See Rule 238 (1)]]  
**UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2019-2020**  
in respect of **RECURRING**  
as on 31/03/2020 to be submitted to SERB  
is the UC (Provisional/Audited)  
(To be given separately for each financial year ending on 31st March)

1. Name of the grant receiving Organization : **GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY**  
2. Name of Principal Investigator(Pi) **SOUMYA SUNDAR MATI**  
3. SERB Sanction order no. & date **TAR/2019/000030, Dated 17/12/2019**  
4. Title of the Project **A Comprehensive Interpretation on Specific Sequence Binding Selectivity of Designed Fluorescent Organic Molecules and Engineered Nanofibers in Genomic DNA and Oligonucleotides through Biophysical Study, Computational Calculation and in-vitro Analysis**  
5. Name of the SERB Scheme **TARE**  
6. Whether recurring or non-recurring grants **RECURRING**  
7. Grants position at the beginning of the Financial year  
(i) Carry forward from previous financial year : **Rs 0**  
(ii) Others, if any : **Rs 0**  
(iii) Total : **Rs 0**

8. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balance of Grants received previous years (figure as at Sl. No. 7(ii))	Interest Earned thereon	Interest deposited back to the SERB	Grants received during the year			Total Available Funds (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
1	2	3	Sanction No. (i)	Date (ii)	Amount (iii)	5	6	7
0	2093	0	TAR/2019/000030	17/12/2019	275000	277093	11906	265187

Component wise utilization of grants:

Grants-in-aid- General	Grant-in-aid-creation for capital assets	Total
11906	0	11906

Details of grants position at the end of the year

(i) Balance available at end of financial year :	265187
(ii) Unspent balance refunded to SERB (if any) :	0
(iii) Balance (Carried forward to next financial year) :	265187

*Soumya Sundar Mati* 30/03/2020  
Name and Signature of Principal Investigator (Seal)  
**Dr. Soumya Sundar Mati**  
Assistant Professor (W.B.E.S.)  
Government General Degree College  
Keshiary, Paschim Medinipur, Pin-721135

*Susanta P. Mukherjee* 30/03/2020  
Signature of Competent Financial Authority (Seal)  
**DR. SUSANTA P. MUKHERJEE**  
Officer-in-Charge  
Govt. Gen. Degree College, Keshiary  
Paschim Medinipur, PIN-721135

For **SUSANTA P. MUKHERJEE & CO**  
Chartered Accountants  
**(Ajokesh Koley)**  
Proprietor, M. N. - 057263

**Statement of Expenditure**  
(from 01/11/2019 to 31/03/2020)

Sr No (I)	Sanctioned Heads (II)	Total Funds Allocated (indicate sanctioned or revised (III))	Expenditure Incurred			Total Expenditure till (VII = IV + V + VI)	Balance as on (date) (VIII = III - VII)	Requirement of Funds upto 31st March next Year	Remarks (if any)
			1st Year (IV) 01/11/2019 to 31/03/2020	2nd Year (V)	3rd Year (VI)				
1	Research Grant	750000	11906	0	0	11906	738094	250000	
2	Overhead	75000	0	0	0	0	75000	25000	
<b>Total</b>		<b>825000</b>	<b>11906</b>	<b>0</b>	<b>0</b>	<b>11906</b>	<b>813094</b>	<b>275000</b>	

*Soumya Sundar Mati* 30/03/2020  
Name and Signature of Principal Investigator:  
**Dr. Soumya Sundar Mati**  
Assistant Professor (W.B.E.S.)  
Government General Degree College  
Keshiary, Paschim Medinipur, Pin-721135

*Susanta P. Mukherjee* 30/03/2020  
Signature of Competent Financial Authority (with seal)  
**SUSANTA P. MUKHERJEE**  
Officer-in-Charge  
Govt. Gen. Degree College, Keshiary  
Paschim Medinipur, PIN-721135

For **SUSANTA P. MUKHERJEE & CO**  
Chartered Accountants  
**(Ajokesh Koley)**  
Proprietor, M. N. - 057263

\* DOS - Date of Start of project

Note:  
1. Expenditure under the sanctioned heads, at any point of time, should not exceed funds allocated under that head, without prior approval of SERB i.e. Figures in Column (VIII) should not exceed corresponding figures in Column (III)  
2. Utilization Certificate (Annexure III) for each financial year ending 31st March has to be enclosed along with request for carry-forward permission to the next financial year.

*Ajokesh Koley*  
Officer-in-Charge  
Govt. Gen. Degree College  
Keshiary



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Government of West Bengal  
Office of the Principal

**GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY**

At.-Telipukur : P.O.- Tilaboni Mahisamura : P.S.- Keshiary

Dist- Paschim Medinipur : PIN-721135

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**2020-21**

GFR 12 - A  
[See Rule 238 (1)]  
**UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2020-2021**  
in respect of **RECURRING**  
as on 31/03/2021 to be submitted to SERB  
is the UC (Provisional/Audited)  
(To be given separately for each financial year ending on 31st March)

1. Name of the grant receiving Organization : **GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY**  
2. Name of Principal Investigator(Pi) : **SOUMYA SUNDAR MATI**  
3. SERB Sanction order no. & date : **TAR/2019/00030, Dated 17/12/2019**  
4. Title of the Project : **A Comprehensive Interpretation on Specific Sequence Binding Selectivity of Designed Fluorescent Organic Molecules and Engineered Nanoclusters in Genomic DNA and Oligonucleotides through Biophysical Study, Computational Calculation and in-vitro Analysis**  
5. Name of the SERB Scheme : **TARE**  
6. Whether recurring or non-recurring grants : **RECURRING**  
7. Grants started at the beginning of the Financial year  
(i) Carry forward from previous financial year : **Rs 265187**  
(ii) Others, if any : **Rs 0**  
(iii) Total : **Rs 265187**

8. Details of grants received, expenditure incurred and closing balances: (Actuals)

Unspent Balance of Grants received previous years (figure as at Sl. No. 7(iii))	Interest Earned thereon	Interest deposited back to the SERB	Grants received during the year	Total Available Funds: (1+2-3+4)	Expenditure incurred	Closing Balances (5-6)
1	2	3	4	5	6	7
			Sanction No. (i) (ii)	Amount (iii)		
265187	1007	0	TAR/2019/00030	19/03/2021	271000	537194
					269498	267696

Component wise utilization of grants:

Grants-in-aid- General	Grants-in-aid-creation for capital assets	Total
269498	0	269498

Details of grants position at the end of the year

(i) Balance available at end of financial year : ...	267696
(ii) Unspent balance refunded to SERB (if any) :	0
(iii) Balance (Carried forward to next financial year) :	267696

**Soumya Sundar Mati** 12/08/21  
Name and Signature of Principal Investigator:  
(Seal)  
**Dr. Soumya Sundar Mati**  
Assistant Professor (W.B.E.S.)  
Government General Degree College  
Keshiary, Paschim Medinipur, Pin-721135

**Susanta P. Mukherjee & Co**  
Chartered Accountants  
For SUSANTA P. MUKHERJEE & CO  
Proprietor: M. N. - 057263  
14/08/21  
**Alokesh Koley**  
Proprietor: M. N. - 057263

**Susanta Chakraborty**  
Officer-in-Charge  
Govt. Gen. Degree College, Keshiary  
West Bengal, 721135

**Statement of Expenditure**  
(from 01/04/2020 to 31/03/2021)

Sr No (I)	Sanctioned Heads (II)	Total Funds Allocated (indicate sanctioned or revised) (III)	Expenditure Incurred			Total Expenditure till (VII - IV + V + VI)	Balance as on (date) (VIII - III - VII)	Requirement of Funds upto 31st March next Year	Remarks (if any)
			1st Year 01/11/2019 to 31/03/2020 (IV)	2nd Year 01/04/2020 to 31/03/2021 (V)	3rd Year (VI)				
1	Research Grant	750000	11906	244498	0	256404	493596	250000	
2	Overhead	75000	0	25000	0	25000	50000	25000	
<b>Total</b>		<b>825000</b>	<b>11906</b>	<b>269498</b>	<b>0</b>	<b>281404</b>	<b>543596</b>	<b>275000</b>	

**Soumya Sundar Mati**  
Name and Signature of Principal Investigator:  
Date: 12/08/21  
**Dr. Soumya Sundar Mati**  
Assistant Professor (W.B.E.S.)  
Government General Degree College  
Keshiary, Paschim Medinipur, Pin-721135

**Susanta P. Mukherjee & Co**  
Chartered Accountants  
For SUSANTA P. MUKHERJEE & CO  
Proprietor: M. N. - 057263  
14/08/21  
**Alokesh Koley**  
Proprietor: M. N. - 057263

**Susanta Chakraborty**  
Signature of Competent financial authority  
(with seal)  
Date: 12/08/21  
**Susanta Chakraborty**  
Officer-in-Charge  
Govt. Gen. Degree College, Keshiary  
West Bengal, 721135

\* DOS - Date of Start of project

Note:

- Expenditure under the sanctioned heads, at any point of time, should not exceed funds allocated under that head, without prior approval of SERB i.e. Figures in Column (VIII) should not exceed corresponding figures in Column (III)
- Utilization Certificate (Annexure III) for each financial year ending 31st March has to be enclosed along with request for carry-forward permission to the next financial year.

**Susanta Chakraborty**  
Officer-in-Charge  
Govt. Gen. Degree College  
Keshiary



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Dist- Paschim Medinipur : PIN-721135  
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**2021-22**

**GFR 12 - A**  
[[See Rule 238 (1)]]  
**UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2021-2022**  
in respect of **RECURRING**  
as on 31/03/2022 to be submitted to SERB  
Is the UC (Provisional/Audited)  
(To be given separately for each financial year ending on 31st March)

- Name of the grant receiving Organization : **GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY**
- Name of Principal Investigator(Pi) **SOUMYA SUNDAR MATI**
- SERB Sanction order no. & date **TAR/2019/000030, Dated 17/12/2019 (1<sup>st</sup> release); TAR/2019/000030, Dated 19/03/2021 (2<sup>nd</sup> release)**
- Title of the Project **A Comprehensive Interpretation on Specific Sequence Binding Selectivity of Designed Fluorescent Organic Molecules and Engineered Nanoclusters in Genomic DNA and Oligonucleotides through Biophysical Study, Computational Calculation and in-vitro Analysis**
- Name of the SERB Scheme : **TARE**
- recurring or non-recurring grants : **RECURRING**
- Composition at the beginning of the Financial year  
(i) Carry forward from previous financial year : **Rs 267696**  
(ii) Others, If any : **Rs 0**  
(iii) Total : **Rs 267696**

Sl. No.	Particulars	Interest Earned thereon	Interest deposited back to the SERB	Grants received during the year	Total Available funds (1+2-3+4)	Expenditure Incurred	Closing Balances (5-6)
1	Carry forward						
2	Grants received						
3	Interest Earned						
4	Interest deposited back						
5	Grants received during the year						
6	Total Available funds						
7	Expenditure Incurred						
8	Closing Balances						

Component wise utilization of grants:

Grants-in-aid- General	Grant-in-aid-creation for capital assets	Total
265491	0	265491

Details of grants position at the end of the year

(i) Balance available at end of financial year : ...	8335
(ii) Unspent balance refunded to SERB (if any) :	0
(iii) Balance (Carried forward to next financial year) :	8335

Soumya Sundar Mati, 22/04/22  
Dr. SOUMYA SUNDAR MATI  
Principal Investigator  
SERB Sanction Order No. TAR/2019/000030  
(Seal)

For SUSANTA P. MUKHERJEE & CO.  
Chartered Accountants  
Proprietor, M. N.-057283  
24/04/2022

Signature of Competent financial authority (Head of Finance)  
Govt. Gen. Degree College  
Keshiary

**Statement of Expenditure**  
(from 01/04/2021 to 31/03/2022)

Sr No (I)	Sanctioned Heads (II)	Total Funds Allocated (indicate sanctioned or revised (III))	Expenditure Incurred			Total Expenditure till. (VII = IV + V + VI)	Balance as on (date) (VIII = III - VII)	Requirement of Funds upto 31st March next Year	Remarks (if any)
			1st Year 01/11/2019 to 31/03/2020 (IV)	2nd Year 01/04/2020 to 31/03/2021 (V)	3rd Year 01/04/2021 to 31/03/2022 (VI)				
1	Research Grant	750000	11906	244498	240491	496895	253105	250000	
2	Overhead	75000	0	25000	25000	50000	25000	25000	
<b>Total</b>		<b>825000</b>	<b>11906</b>	<b>269498</b>	<b>265491</b>	<b>546895</b>	<b>278105</b>	<b>275000</b>	

Soumya Sundar Mati  
Name and Signature of Principal Investigator:  
Date: 22.04.2022

Dr. SOUMYA SUNDAR MATI  
Principal Investigator  
SERB-TARE, Project Ref. No. TAR/2019/000030

Signature of Competent financial authority:  
(with seal) Date: 24/04/2022  
Officer-in-Charge  
Govt. Gen. Degree College  
Keshiary

\* DOS - Date of Start of project

Note:

- Expenditure under the sanctioned heads, at any point of time, should not exceed funds allocated under that head, without prior approval of SERB i.e. Figures in Column (VIII) should not exceed corresponding figures in Column (III)
- Utilization Certificate (Annexure III) for each financial year ending 31st March has to be enclosed along with request for carry-forward permission to the next financial year.

For SUSANTA P. MUKHERJEE & CO.  
Chartered Accountants  
Proprietor, M. N.-057283  
24/04/2022

Signature of Competent financial authority (Head of Finance)  
Govt. Gen. Degree College  
Keshiary

Officer-in-Charge  
Govt. Gen. Degree College  
Keshiary





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Dist- Paschim Medinipur : PIN-721135  
www.ggdckeshiary.ac.in

**2022-23**

**GFR 12 - A**  
[(See Rule 238 (1))]  
**UTILIZATION CERTIFICATE (UC) FOR THE YEAR 2022-2023**  
In respect of **RECURRING**  
as on 30/04/2023 to be submitted to SERB  
Is the UC (Provisional/Audited)  
(To be given separately for each financial year ending on 31st March)

1. Name of the grant receiving Organization - **GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY**  
2. Name of the Principal Investigator(PI) **SOUMYA SUNDAR MATI**  
3. SERB Sanction order no. & date **TAR/2019/000030, Dated 17/12/2019 (1<sup>st</sup> release); TAR/2019/000030, Dated 19/03/2021 (2<sup>nd</sup> release); TAR/2019/000030, Dated 29/06/2022 (3<sup>rd</sup> release)**  
4. Title of the Project **A Comprehensive Interpretation on Specific Sequence Binding Selectivity of Designed Fluorescent Organic Materials and Engineered Nanocatalysts in Genetic DNA and Oligonucleotides through Biophysical Study, Computational Calculation and in-vitro Analysis**  
5. Name of the SERB Scheme - **TARE**  
6. Whether recurring or non-recurring grants - **RECURRING**  
7. Grants position at the beginning of the Financial year  
(i) Carry forward from previous financial year : **Rs 8335**  
(ii) Others, If any : **Rs 0**  
(iii) Total : **Rs 8335**

Details of grants received, expenditure incurred and closing balances: (Actuals)

Grant Balance	Interest Earned	Interest deposited back	Grants received during the year	Total Available funds (1+2+3+4)	Expenditure incurred	Closing Balances (5-6)
1	2	3	4	5	6	7
8335	7413	0	TAR/2019/000030	210090	225748	224637
			Sanction No. (i)	Date (ii)	Amount (iii)	
				19/06/2022	210090	

Component wise utilization of grants:

Grants in-aid- General	Grant-in-aid-creation for capital assets	Total
224637	0	224637

Details of grants position at the end of the year

(i) Balance available at end of financial year : ...	1111
(ii) Unspent balance refunded to SERB (If any) :	1111 For SUSANTA P. MUKHERJEE & CO. Chartered Accountants
(iii) Balance (Carried forward to next financial year) :	0

**Soumya Sundar Mati** 06/06/2023  
Name and Signature of Principal Investigator:  
DR. SOUMYA SUNDAR MATI  
Principal Investigator  
SERB-TARE, Project Ref. No. TAR/2019/000030

**DR. SUDIPTA CHAKRABORTY**  
Signature of Competent financial authority (Head of Finance):  
(Seal) DR. SUDIPTA CHAKRABORTY  
Officer-in-Charge  
Govt. Gen. Degree College, Keshiary  
West Bengal, 721135

**(Aakash Koley)**  
Proprietor, M. N -057263

**Statement of Expenditure**  
(from 01/11/2019 to 30/04/2023)

Sr No (I)	Sanctioned Heads (II)	Total Funds Allocated (indicate sanctioned or revised (III))	Expenditure Incurred				Total Expenditure till (VII = IV + V + VI + VI A)	Balance as on (date) (VIII = III - VII)	Requirement of Funds upto 31st March next Year	Remarks (if any)
			1 <sup>st</sup> Year 01/11/2019 to 31/03/2020 (IV)	2 <sup>nd</sup> Year 01/04/2020 to 31/03/2021 (V)	3 <sup>rd</sup> Year 01/04/2021 to 31/03/2022 (VI)	4 <sup>th</sup> Year 01/04/2022 to 30/04/2023 (VI A)				
	Research Grant	697643	11906	244498	240491	199637	696532	1111	0	
	Overhead	75000	0	25000	25000	25000	75000	0	0	
	<b>Total</b>	<b>772643</b>	<b>11906</b>	<b>269498</b>	<b>265491</b>	<b>224637</b>	<b>771532</b>	<b>1111</b>	<b>0</b>	

**Soumya Sundar Mati**  
Name and Signature of Principal Investigator:  
Date: 13.06.2023

**DR. SOUMYA SUNDAR MATI**  
Principal Investigator  
SERB-TARE, Project Ref. No. TAR/2019/000030

**DR. SUDIPTA CHAKRABORTY**  
Signature of Competent financial authority:  
(with seal) Date: 13/06/2023  
DR. SUDIPTA CHAKRABORTY  
Officer-in-Charge  
Govt. Gen. Degree College, Keshiary  
West Bengal, 721135

\* DOS - Date of Start of project

Note:

- Expenditure under the sanctioned heads, at any point of time, should not exceed funds allocated under that head, without prior approval of SERB i.e. Figures in Column (VIII) should not exceed corresponding figures in Column (III)
- Utilization Certificate (Annexure III) for each financial year ending 31st March has to be enclosed along with request for carry-forward permission to the next financial year.

**(Aakash Koley)**  
Proprietor, M. N -057263

**(Aakash Koley)**  
Officer-in-Charge  
Govt. Gen. Degree College  
Keshiary



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Dist- Paschim Medinipur : PIN-721135

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**4. Project completion acknowledgement from SERB**

6/15/24, 2:32 PM GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY Mail - Fwd: SERB-Notification

Gmail Soumya Sundar Mati <ssmati\_chem@ggdckeshiary.ac.in>

**Fwd: SERB-Notification**  
1 message

**soumya sundar Mati** <soumyamati@gmail.com> Sat, Jun 15, 2024 at 2:30 PM  
To: ssmati\_chem@ggdckeshiary.ac.in

----- Forwarded message -----  
From: <SERB\_Administrator@serbonline.in>  
Date: Wed, Jun 12, 2024 at 2:27 PM  
Subject: SERB-Notification  
To: <info@serbonline.in>

**Science and Engineering Research Board**  
(Statutory Body Established Through an Act of Parliament : SERB Act 2008)  
Department of Science and Technology, Government of India

**Closure acknowledgement to the Convener / PI**  
Anusandhan National Research Foundation (ANRF)  
(A statutory body created by an Act of Parliament - ANRF Act, 2023)

ANRF  
3rd & 4th Floor, Block II  
Technology Bhavan, New Mehrauli Road  
New Delhi - 110016

File Number: TAR/2019/000030  
Dated: 12-Jun-2024

Subject: Project titled " A Comprehensive Interpretation on Specific Sequence Binding Selectivity of Designed Fluorescent Organic Molecules and Engineered Nanoclusters in Genomic DNA and Oligonucleotides through Biophysical Study, Computational Calculation and in-vitro Analysis "

Dear Dr. SOUMYA SUNDAR MATI

The ANRF has received the required financial documents and the same have been accepted. Hence, this file is closed officially. This is for your kind information.

Yours sincerely,

( Dr. Shilpi Paul )  
Scientist F  
Email: shilpi@serb.gov.in

Dr. SOUMYA SUNDAR MATI  
GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY,

<https://mail.google.com/mail/u/0/?ik=cd3626c762&view=pt&search=all&permthid=thread-f:1801917103531787270&simpl=msg-f:1801917103531...> 1/2

Officer-in-Charge  
Govt. Gen. Degree College  
Keshiary





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Government of West Bengal  
Office of the Principal

# GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY

At.-Telipukur : P.O.- Tilaboni Mahisamura : P.S.- Keshiary  
Dist- Paschim Medinipur : PIN-721135  
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## 5. Project completion Certificate from IIT, Kharagpur

	<b>INDIAN INSTITUTE OF TECHNOLOGY KHARAGPUR</b> <b>Sponsored Research &amp; Industrial Consultancy</b> Nalanda Complex, IIT Kharagpur, Post Office - Kharagpur, Dist. - Paschim Medinipur, West Bengal - 721302, India
No: IIT/SRIC/R/TEG/2023/M2020006 Dated: October 13, 2023	
<b><u>TO WHOM IT MAY CONCERN</u></b>	
Press <b>Esc</b> to exit full screen	This is to certify that <b>Dr. Soumya Sundar Maiti (M2020006)</b> was a <b>Co Principal Investigator</b> in the temporary research project entitled " <b>Teachers Associateship for Research Excellence (TARE) to Dr. Soumya Sundar Maity, Govt. General Degree College Keshiary (TEG)</b> ", sponsored by SERB, New Delhi, undertaken in the Department of Chemistry of this institute from 01-11-2019 for a period upto 31-01-2023.
 Jeneeta Joseph (Assistant Registrar)	
Telephone: Recruitment unit: 03222-282193 Purchase unit: 03222-282149 Billing unit: 03222-282199	E-mail: Dean (SRIC): deansr@hijil.iitkgp.ac.in Joint Registrar (SRIC): jregsric@sr.ic.iitkgp.ac.in Assistant Registrar (SRIC): aregsric-2@sr.ic.iitkgp.ac.in (Payment) Assistant Registrar (SRIC): aregsric-3@sr.ic.iitkgp.ac.in (Purchase)

  
Officer-in-Charge  
Govt. Gen. Degree College  
Keshiary



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Government of West Bengal  
Office of the Principal

# GOVERNMENT GENERAL DEGREE COLLEGE, KESHIARY

At.-Telipukur : P.O.- Tilaboni Mahisamura : P.S.- Keshiary  
Dist- Paschim Medinipur : PIN-721135  
www.ggdckeshiary.ac.in

## 6. Acknowledgement of SERB, India in the Publications

International Journal of Biological Macromolecules 242 (2023) 124933

Contents lists available at ScienceDirect

International Journal of Biological Macromolecules

Journal homepage: [www.elsevier.com/locate/ijbiomac](http://www.elsevier.com/locate/ijbiomac)



### Targeting genomic DNAs and oligonucleotide on base specificity: A comparative spectroscopic, computational and in vitro study

Soumya Sundar Mati<sup>a,\*</sup>, Sourav Chowdhury<sup>b,1</sup>, Soumen Sarkar<sup>c</sup>, Nanigopal Bera<sup>d</sup>, Nilmoni Sarkar<sup>d</sup>

<sup>a</sup> Department of Chemistry, Government General Degree College, Keshiary, Paschim Medinipur, WB 721135, India  
<sup>b</sup> Structural Biology and Bio-Informatics division, CSIR Indian Institute of Chemical Biology, Kolkata 700032, India  
<sup>c</sup> Department of Chemistry, Bidarhat College, Bidarhat, Durgam, WB 721301, India  
<sup>d</sup> Department of Chemistry, Indian Institute of Technology, Kharagpur, Paschim Medinipur, WB 721302, India

#### ARTICLE INFO

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#### ABSTRACT

Drug discovery in targeted nucleic acid therapeutics encompass several stages and rigorous challenges owing to less specificity of the DNA binders and high failure rate in different stages of clinical trials. In this perspective, we report newly synthesized ethyl 4-(pyrrolo[1,2-a]quinolin-4-yl)benzoate (PQN) with minor groove A-T base pair binding selectivity and encouraging *in cell* results. This pyrrolo quinolin derivative has shown excellent groove binding ability with three of our inspected genomic DNAs (gpDNA 73% AT, cDNAS58% AT and mDNA 28% AT) with varying A-T and G-C content. Notably in spite of similar binding patterns PQN have strong binding preference with A-T rich groove of genomic cpDNA over the cdDNA and mdDNA. Spectroscopic experiments like steady state absorption and emission results have established the relative binding strengths ( $K_{bb} = 6.3 \times 10^7 \text{ M}^{-1}$ ,  $5.6 \times 10^6 \text{ M}^{-1}$ ,  $4.3 \times 10^6 \text{ M}^{-1}$  and  $K_{cat} = 6.1 \times 10^5 \text{ M}^{-1}$ ,  $5.7 \times 10^4 \text{ M}^{-1}$  and  $3.5 \times 10^4 \text{ M}^{-1}$  for PQN-gpDNA, PQN-cdDNA and PQN-mdDNA respectively) whereas circular dichroism and thermal melting studies have unveiled the groove binding mechanism. Specific A-T base pair attachment with van der Waals interaction and quantitative hydrogen bonding assessment were characterized by computational modeling. In addition to genomic DNAs, preferential A-T base pair binding in minor groove was also observed with our designed and synthesized deca-nucleotide (primer sequences 5'-GGGAATCCG-3' and 3'-CGCTTAAAGG-5'). Cell viability assays (86.13 % in 6.58  $\mu\text{M}$  and 84.01 % in 9.88  $\mu\text{M}$  concentrations) and confocal microscopy revealed low cytotoxicity ( $\text{IC}_{50}$  25.86  $\mu\text{M}$ ) and efficient perinuclear localization of PQN. We propose PQN with excellent DNA-minor groove binding capacity and intracellular permeation properties, as a lead for further studies encompassing nucleic acid therapeutics.

#### 1. Introduction

Deoxyribonucleic acid (DNA) is the storage unit and fundamental part of cellular machinery to carry forward hereditary information and facilitates biological synthesis of various enzymes and proteins through replication and transcription [1,2]. The coding region of genomic DNA consists of extremely conserved sequence which expresses protein for cell existence [3,4]. Many critical diseases like cancer are related to this gene expression and need to control under therapeutic managements. In this perspective to avoid DNA-protein interaction during significant contact involved in major or minor groove, small molecules that bind

major or minor groove of DNA are designed to inhibit this type of interactions [5]. From previous decades this is why the design and construction of new and efficient DNA targeted molecules are explored for this purpose [6-9]. Regarding this with many similar detailed investigations of Chamani et al. [10-14], the p-Synephrine interaction with calf thymus DNA and impact of linker histone in the binding interaction between ambolchiron and calf thymus DNA is notably momentous [15,16]. Corresponding DNA binding activity of malathion complex and synthesized pyrimido pyrazole derivative have recently reported [17,18]. In addition to synthesized molecules, many natural alkaloids and flavonoid are used to investigate such DNA-small molecule

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involved in PQN-oligo complex. So, these detailed results hereby insist that newly synthesized PQN molecule prefers A-T rich region of DNA minor groove irrespective of whether it is junk genomic DNA or small oligonucleotide. Moreover, the binding strength prefers the manner of crescent shaped pattern and number of dedicated binding forces (hydrogen bond, van der Waal and polar interaction) involved.

#### 3.6. MTT assay

MTT based viability assay conducted with the HeLa cells showed >80 percent cellular viability was obtained for treatment with PQN compound concentration equal or lower than 9.88  $\mu\text{M}$  (Fig. 7A). We carried out our MTT assay across a concentration gradient of the PQN, spanning from 50 to 0.86  $\mu\text{M}$  (Fig. 7A) referring to a previously published protocol [73]. We derived the  $\text{IC}_{50}$  of the PQN from the percent viability values obtained across the PQN concentration gradient used for the MTT assay. Half maximal inhibitory concentration or  $\text{IC}_{50}$  of the PQN was to be 25.86  $\mu\text{M}$ . *In cell* imaging experiments were proceeded using 6.58 (mean % cell viability 86.13) and 9.88  $\mu\text{M}$  (mean % cell viability 84.01) concentrations.

#### 3.7. Imaging experiments

HeLa cells were treated with PQN for varying lengths of time, spanning from 15 min to 3 h. During imaging experiments 6.58  $\mu\text{M}$  or 9.88  $\mu\text{M}$  PQN concentration was used. We carried out confocal microscopy for each of these two concentrations and for six different treatment time frames. To understand the optimal imaging condition, we carried out image quantification at all the time points and for both the probe concentrations tested. We observed a treatment time frame of 2 h with a probe concentration of 9.88  $\mu\text{M}$  to be the optimal for imaging (Fig. 7B). The luminosity observed after 3 h was found to be little lower than 2 h readout with 9.88  $\mu\text{M}$  probe compound treatment. This could be attributed to some cellular degradation of the probe compound or internal cytoplasmic quenching owing to some cellular process [74,75]. PQN was found to get permeated inside cell cytosol with detectable optical signal within 30 min of treatment and it had no effect on cell shape as compared to the control cell set with no probe compound treatment (Fig. 7C and D). The luminosity was found to be higher in the 1-h treatment set (Fig. 7E). We found that two hours of treatment with the probe compound at 9.88  $\mu\text{M}$  to be ideal as observed cells were brighter and with no effect on cell shape and margin (Fig. 7F and G). Image quantification carried out on the cell-set with 3-h treatment showed a median luminosity of 23 and efficient cytoplasmic distribution as indicated by the surface plot (Fig. 7G). To have a quantitatively precise insight about the PQN cytosolic distribution we went to quantify the PQN associated fluorescence around nuclear membrane as a proxy to probe into the nuclear permeation. Quantification revealed relatively higher PQN localization around the nuclear membrane with a progressively increasing count with the passage of time (Fig. 7H) as it is interesting to note that the median intensity of the PQN perinuclear localization varied across the time gradient suggesting that PQN perinuclear distribution with negligible cellular quenching and predicted genomic DNA binding is a function of PQN-cell pre-incubation time. This further suggests that PQN has efficient perinuclear localization, an essential criterion to be an effective in cell genomic DNA binder.

#### 4. Conclusion

In search of new DNA binding probe compounds for regulating DNA functions and/or understanding the conformational change in the DNA molecule under different cellular conditions viz. spanning from cell division to stress induced cell cycle arrest, in this article we have shown a newly synthesized PQN molecule and its binding with three disparate giant genomic DNA variants (gpDNA 73 % AT, cDNAS58% AT and

mdDNA 28 % AT). Notably these individual genomic DNA variants compositionally differ in their nucleobases with varying A-T and/or G-C percentages. We show that PQN molecule has excellent minor groove binding ability and preferentially interacts with A-T rich base pairs, as a result shows higher binding strength with cpDNA compared to other two variants. To have more detailed we report an interaction of PQN with designed and synthesized small oligonucleotide which also shows strong binding affinity of PQN in the A-T rich region of the minor groove of the oligonucleotide. The similar activity of PQN from genomic DNAs to small designed oligonucleotide is also an encouraging uniqueness of this study. In the next step, our *in cell* experiments show that PQN has an excellent cell permeation property and do not result in any permeation induced cytotoxicity. We report that with an optimal concentration of ~9.8  $\mu\text{M}$  PQN retains its fluorescence >2 h and do not show any visible impact on cell shape and integrity. Our future studies would involve an ensemble of cell-based investigation to understand the permeation dynamics of PQN inside cell nucleus and how it can be used to probe DNA metabolism, in turn as a marker of cellular stress. The present study deploying both experimental and computational approaches has identified the specified stacking sectors of PQN for giant genomic DNAs alongside with small oligonucleotides with complementary *in cell* results. Probing DNA metabolism under varying conditions of cell stress and functionally regulating DNA conformation has been two discrete challenges [76,77]. We propose that PQN could be an excellent lead molecule to probe in both frontiers. We acknowledge that our cell-based assays although exceedingly promising is currently restricted to whole cytosol based findings and having a more detailed and comprehensive analysis was beyond the scope of the current work. Also, future work would encompass strategies to effectively quantify intracellular DNA binding using the fluorescence property of PQN by deploying previously published protocols [78-80]. But with logical next cell-based steps and with data currently reported PQN can be an excellent lead to also work in other cell systems and in physiologically diverse contexts. Thus, seeking for reduced toxicity and alternative mechanisms in the arena of nucleic acid targeted drug discovery, we propose PQN as a lead molecule in more specific studies and applications in future.

#### CRediT authorship contribution statement

S. S. Mati: Conceptualization, Methodology, Software, Investigation, Visualization, Writing - Original draft preparation, Funding acquisition. S. Chowdhury: Data curation, Writing - Original draft preparation. S. Sarkar: Formal analysis, N. Bera: Data Curation, N. Sarkar: Conceptualization, Supervision, Project administration.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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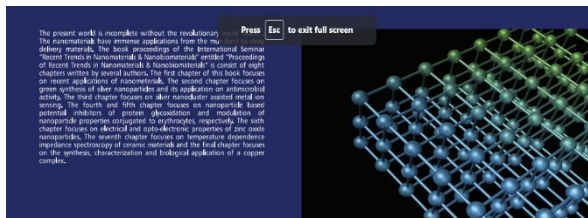


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The present world is incomplete without the revolution of nanomaterials. The nanomaterials have immense applications from the medicine, electronics, agriculture, etc. The book proceedings of the International Seminar "Recent Trends in Nanomaterials & Nanobiotechnology" is a collection of eight chapters written by several authors. The first chapter of this book focuses on recent applications of nanomaterials. The second chapter focuses on green synthesis of silver nanoclusters and its application in antimicrobial activity. The third chapter focuses on silver nanocluster assisted metal ion sensing. The fourth and fifth chapters focus on nanomaterials as novel potential inhibitors of protease glycosidation and modulation of hepatocellular carcinoma (HCC) respectively. The sixth chapter focuses on chemical and optoelectronic properties of zinc oxide nanoparticles. The seventh chapter focuses on simulation of density functional theory of organic materials and the final chapter focuses on the synthesis, characterization and biological application of a copper complex.

TAPANWENDU KAMLAJA

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Dr. Tapanendu Kamlaia is an Assistant Professor in the Department of Physics at Keshariya College since 2008. His research interests span both nanoscience and biophysics. He has published more than 50 research papers in reputed international journals. As of 2020, Google Scholar reports over 713 citations to his work.



Silver Nanocluster assisted Metal Ion Sensing

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Abstract

Metal nanoclusters, nowadays, have attracted special attention due to their biocompatibility and optical appearance. Among them silver nanoclusters (AgNC) is of special interest owing to its versatile property from optical to biological applications. In this work, it has been shown that tiny sized poly(ethyleneimine) capped AgNC (PEI-AgNC) (size ~2.4 nm) can distinguish cobalt ion (Co<sup>2+</sup>), among a series of metal ions. Cobalt ions has important biological role due to its presence in vitamin B<sub>12</sub> (cobalamin). On the other hand, excess Co<sup>2+</sup> may cause rhinitis, allergic dermatitis, and asthma. A plausible mechanism has also been demonstrated which explains that PEI can no longer stabilize the AgNC in presence of Co<sup>2+</sup> and it leads to aggregation.

**Keywords:** Metal nanoclusters, Silver nanoclusters, Cobalt ion, aggregation, Fluorescence

1. Introduction

Metal nanoclusters are ultra small particles having particle size below 2 nm, which consist of several to hundred atoms. This brings them to show molecular like behaviour e.g., electronic transition, fluorescence, etc. Out of these nanoclusters, silver nanoclusters (AgNC) are of special interest. Till now many synthetic strategies have been developed for the synthesis of AgNC using soft template like DNA, protein, peptide etc. Recently, many studies on AgNC based sensors have been reported. Some of them are DNA capped AgNC served as Cu<sup>2+</sup>, malrose functionalized AgNC for specific detection of glycoprotein, bovine serum albumin stabilized AgNC have been used to recognize cyanide, and for Hg<sup>2+</sup> detection, mercaptopropionic acid template AgNC was applied<sup>1-6</sup>. However, these are very limited. Therefore, this work aims to sense particular metal ion cobalt (Co), exclusively. The Cobalt (Co) is an important element in human body, since, it is the building block of vitamin B<sub>12</sub>.

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Similarly, imine moiety form stable complex with Co<sup>2+</sup> as well as AgNC become destabilized to form non-fluorescence AgNC aggregates having size 10 nm.

4. Conclusion

In conclusion, a simple method for cobalt ion sensing has been described using water soluble PEI capped silver nanoclusters. These nanoclusters may be used in different other studies in future.

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**Chapter 13**

**Interaction of Small Molecules with DNA: An Overview on Mode of Binding**

**Somya Sundar Maiti<sup>1\*</sup>, Pooja Paul<sup>1,2</sup>**

**DNA binding small molecules is of immense interest in the arena of medicinal or clinical chemistry. Here, this study embodies a detailed investigation of binding mode between two small molecules (a Naphthalimide derivative and a phenothiazinone dye namely thionine) with double stranded DNA. With the help of some established biophysical tools like absorbance, fluorescence, circular dichroism and melting, the mode of binding of thionine was found to be intercalative. Alongside, it was also inferred that the Naphthalimide derivative as a thin ribbon-like molecules was involved in groove binding mode through hydrogen bonding or van der Waals interaction with the nucleic acid bases in the shallow minor groove of the HFDNA. Theoretical interpretation also supported the findings of experimental evidences.**

**Introduction:**  
Studying the interaction of small molecules with DNA carries high significance as they are supposed to exert their primary biological effects by modulating transcription or by interfering with replication[1]. Usually, drugs bind to DNA under the following three dominant non covalent modes of interactions: (1) electrostatic, (2) intercalation and (3) groove. In electrostatic binding molecules are attached with the phosphate backbone of DNA through the electrostatic attraction. Intercalation is the insertion of molecules between the planar bases of deoxyribonucleic acid thereby distorting the DNA backbone conformation. Molecular aspect of the interaction of many aromatic molecules that essentially bind by intercalation with DNA has been the subject matter of a large number of

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**Conclusion:**  
A cadre of new biotech has set their sights on targeting DNA with small-molecule drugs in the hope of designing DNA binding therapeutics. We conclude that THD, a planar charged molecule is capable of inserting between the base pairs of DNA molecule with strong intercalative binding whereas long chain aliphatic group containing NPD molecule only manages to grab around the groove of DNA. Present study differentiates them through various experimental and theoretical studies.

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