

NO. SB/FT/CS-121/2013
Science and Engineering Research Board
(SERB)

Technology Bhavan,
New Mehrauli Road,
New Delhi - 110016

Date: 22.11.2013

ORDER

Subject: Financial assistance for the research project entitled "Interaction of DNA with cationic lipids or surfactants: Complexation and decomplexation study" under the guidance of Dr. Tandraima Choudhuri, Assistant Professor, Department of Chemistry, Dr. B. N. Dutta Smriti Mahavidyalaya, Burdwan-713407.

The sanction of the SERB is hereby accorded to the above-mentioned project at a total cost of Rs. 1842000/- (Rupees eighteen lakh forty two thousand only) with break-up of Rs. 700000/- (Rupees seven lakh only) under Capital head and Rs. 1142000/- (Rupees eleven lakh forty two thousand only) under General head for a duration of three years. The items of expenditure for which the total allocation of Rs. 1842000 /- has been approved for a period of three years, are given below:

(Amount in Rs.)

A. Non-recurring (Capital Items)

HEAD	TOTAL
<i>Equipments: Digital balance, Sonicator, Tensiometer, UV spectrophotometer with focal circulatory water bath</i>	700000
Total - Capital	700000

B. Recurring Items (General)

HEAD	TOTAL
<i>Manpower: Project Assistant-01 (Rs. 12000/-PM for I, II year and III year)</i>	432000
<i>Consumables:</i>	300000
<i>Travel:</i>	60000
<i>Contingencies:</i>	60000
<i>General - A: (Manpower + Consumables, Travel, Contingencies)</i>	852000
<i>General - B: OVERHEADS</i>	290000
Total (General) (General-A+ General-B)	1142000
TOTAL (A+B)	1842000

2. Overhead expenses are meant for the host Institute towards the cost for providing infrastructural facilities and benefits to the staff employed in the project etc.

3. The sanction of the SERB is also accorded to the payment of Rs. 1050000/- (Rupees ten lakh fifty thousand only) [Rs. 700000/- (Rupees seven lakh only) under 'Grants for creation of capital assets' and Rs. 350000/- (Rupees three lakh fifty thousand only) under 'Grants-in-aid General'] to The Principal, Dr. B. N. Dutta Smriti Mahavidyalaya, Burdwan being the first installment of the grant for the year 2013-14 for implementation of the said research project.

4. Sanction of the grant is subject to the conditions as detailed in Annexure - I.

5. The amount of **Rs. 1050000/- (Rupees ten lakh fifty thousand only)** will be drawn by the Drawing and Disbursing Officer of the SERB and will be disbursed by means of cheque/DD favouring **The Principal, Dr. B. N. Dutta Smriti Mahavidyalaya, Burdwan** and will be sent to The Principal, Dr. B. N. Dutta Smriti Mahavidyalaya, Hatgobindapur, Burdwan- 713407 (West Bengal).

NO. SB/FT/CS-121/2012
SCIENCE & ENGINEERING RESEARCH BOARD

5 & 5A, Lower Ground Floor
Vasant Square Mall
Plot No. A, Community Centre
Sector-5, Pocket-5
Vasant Kunj
New Delhi-110070

Dated: 05.12.2014

ORDER

Subject: Research project titled "Interaction of DNA with cationic lipids or surfactants: Complexation and decomplexation study" under the guidance of Dr. Tandraima Chaudhuri, Assistant Professor, Department of Chemistry, Dr. B. N. Datta Smriti Mahavidyalaya, Burdwan- 713407 (West Bengal) - Release of grant.

In continuation of DST/SERB's Sanction Order even No. dated 22.11.2013, Sanction of the Science & Engineering Research Board (SERB) is hereby accorded to the payment of a sum of **Rs. 350000/- (Rupees three lakh fifty thousand only)** under recurring as the grant for the year 2014-15 for the above mentioned project.

2. Sanction of the competent authority is also accorded to the carry forward of unspent balance of **Rs. 50000/-** from the FY 2013-14 to CFY 2014-15.
3. Sanction of the grant is subject to the condition as detailed in Terms & Conditions available at website (www.serb.gov.in).
4. It is certified that provision of 212 relating to the UCs for the funds released earlier to this project have been satisfied and the UC/s is/are enclosed.
5. The expenditure involved is debitable to Fund for Science & Engineering Research (FSER) (Recurring). This release is being made under Start-Up Research Grant (Young Scientists) - CHEMICAL SCIENCES.
6. The Sanction has been issued with the approval of the competent authority under delegated powers and vide Diary No. **SERB/F/6186/2014-15** dated **01.12.2014**.
7. The amount of **Rs. 350000/- (Rupees three lakh fifty thousand only)** in question will be drawn by the Finance & Budget Officer of the SERB and will be disbursed by means of RTGS transaction as per their Bank details given below.

Account Name	PANDEP
Account Number	11184012312
Bank Name & Branch Address	STATE BANK OF INDIA, 00048 - COURT COMPOUND, BURDWAN
IFSC/RTGS Code	SBIN0000048
PI's Email ID	tanchem_bu@yahoo.co.in

Contd...2/

NO. 58/FT/CS-121/2012
SCIENCE & ENGINEERING RESEARCH BOARD

5 & 5A, Lower Ground Floor
Vasant Square Mall
Plot No. A, Community Centre
Sector-5, Pocket 5
Vasant Kunj
New Delhi-110070

Dated: 29.01.2016

ORDER

Subject: Research project titled "Interaction of DNA with cationic lipids or surfactants: Complexation and decomplexation study" under the guidance of Dr. Tandrima Chaudhuri, Assistant Professor, Department of Chemistry, Dr. B. N. Dutta Sairiki Mahavidyalaya, Burdwan- 713407 (West Bengal) - Release of grant.

In continuation of DST/SERB's Sanction Order even No. dated **05.12.2014**, Sanction of the **Science & Engineering Research Board (SERB)** is hereby accorded to the payment of a sum of **Rs. 300000/- (Rupees three lakh only)** under recurring as the grant for the year 2015-16 for the above mentioned project.

2. Sanction of the grant is subject to the condition as detailed in Terms & Conditions available at website (www.serb.gov.in).
3. It is certified that provision of 212 relating to the UCs for the funds released earlier to this project have been satisfied and the UC/s is/are enclosed.
4. The expenditure involved is debitable to **Fund for Science & Engineering Research (FSER) (Recurring)**. This release is being made under **Start-Up Research Grant (Young Scientists) - CHEMICAL SCIENCES**.
5. The Sanction has been issued with the approval of the competent authority under delegated powers and vide Diary No. **SERB/F/7582/2015-16 dated 28.01.2016**.
6. The amount of **Rs. Rs. 300000/- (Rupees three lakh only)** will be drawn by the Finance & Budget Officer of the SERB and will be disbursed by means of RTGS transaction as per their Bank details given below:-

Account Name	The Principal
Account Number	11184012312
Bank Name & Branch Address	State Bank of India, 00048 Court Compound, Burdwan
IFSC/RTGS Code	SBIN0000048
PI's Email ID	tanchem_bu@yahoo.co.in

F. NO.SB/FT/CS-121/2012

Science and Engineering Research Board

(a statutory body of the Department of Science & Technology, Government of India)

5 & 5A, Lower Ground Floor
Vasant Square Mall
Plot No. A, Community Centre
Sector-5, Pocket-5
Vasant Kunj
New Delhi-110070

Dated:26.11.2018

ORDER

Subject: - Financial assistance for the research project entitled "Inteaction of DNA.....decomplexation study " by Dr. Tandrima Chaudhuri, Dr. B N Dutta Smriti Mahavidyalaya, Burdwan.

In continuation of this SERB sanction order even no. SB/FT/CS-121/2012 sanction of the Science Engineering Research Board (SERB) is here by accorded for revising the total cost of the completed project from **Rs.18,42,000/-** to **Rs.17,94,081/-** with the revised allocation, based on actual expenditure being as follows:-

(Amount in Rs.)

A. Non Recurring (Capital items)		
Head	Initial Sanctioned Budget	Revised Budget
Equipment	700000	700000
B. Recurring Items (General)		
Head	Initial Sanctioned Budget	Revised Budget
General A (Manpower, Consumables, Contingency, Travel)	852000	804081
General -B (Overhead)	290000	290000
Total General	1142000	1094080
Total cost of Project (A+B)	1842000	1794080

- Sanction is also accorded to the payment of a sum of **Rs.90,000/- (Rs. Ninety Thousand Only)** being the last and final installment of the grant under recurring head for the above mentioned project. **Utilization certificate and final statement of expenditure be submitted after utilization of this grant.**
- Sanction of the grant is subject to the conditions as detailed in Terms & Conditions available at the SERB website (www.serb.gov.in).
- As per rule 211(1) of GFR the accounts of Grantee Institution shall be open to inspection by sanctioning authority/audit whenever the Institution is called upon to do so.
- The expenditure involved is debitable to **Fund for Science & Engineering Research (FSER)**. This release is being made under Start- Up Research Grant- Chemical Sciences.
- It is certified that provision of 212 of GFR relating to the Utilization Certificate for the funds released under this project have been satisfied and the UC/s is/are enclosed.
- The Institute will maintain separate audited accounts for the Project. It is found expedient to keep a part or whole of the grant in a bank account earning interest. The interest earned should be reported to the SERB. The interest thus earned will be treated as a credit to the institute to be adjusted towards further installment of the grant.

8. The amount of Rs.90,000/- (Rs. Ninety Thousand Only) in question will be drawn by the Finance & Budget Officer of the SERB and will be disbursed by means of RTGS transaction as per their Bank details given below:-

Account Name	Principal , Dr. B N Dutta Smriti Mahavidyalaya
Account Number	11184012312
Bank Name & Branch Address	State Bank of India
IFSC/RTGS Code	SBIN0000048
PI's Email ID	tanchem_bu@yahoo.co.in


9. The Sanction has been issued with the approval of the competent authority under delegated powers and vide Diary No. SERB/F/9561/2018-2019 dated 20.11.2018.

10. The Institute will furnish to the SERB, Utilization Certificate and an audited Statement of Account pertaining to the grant immediately after the utilization of this grant.

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

12. 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.


13. 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 the Department of Science & Technology (DST), Government of India.


(Dr. S V Prasanna)
Scientist - C

To,
Finance & Budget Officer
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. Tandrima Chaudhuri, Dr. B N Dutta Smriti Mahavidyalaya, Burdwan
5.	The Principal, Dr. B N Dutta Smriti Mahavidyalaya, Burdwan


(Dr. S V Prasanna)
Scientist - C

PROJECT COMPLETION REPORT

1. <u>Project Title:</u> <i>Interaction of DNA with cationic Lipids or surfactants: Complexation and decomplexation study.</i>	DST No.: SB/FT/CS-121/2012 dated 22.11.2013
2. <u>PI (Name & Address):</u> <i>Dr. Tandrima Chaudhuri Assistant Professor of Chemistry Dr. B. N. Dutta Smriti Mahavidyalaya Hatgobindapur, Burdwan -713407.WB. Tel. 03422584616(O), 03326739098(R) Fax. +91-342-2584616 Mob. 09932755527 Email: tanchem_bu@yahoo.co.in</i>	Date of Birth: 20/03/1976
3. <u>Broad area of research:</u> <i>Chemical Sciences</i>	
3.1 <u>Sub area :</u> <i>Physical Chemistry</i>	
4. <u>Approved Objectives of the Proposal :</u> <ol style="list-style-type: none"> 1. <i>To develop efficient in vitro and then in vivo procedure for DNA compaction in relation to transfection.</i> 2. <i>To generate more efficient nonviral vectors, it is appealing to try to combine the favorable features of cationic surfactants and cationic lipids.</i> 3. <i>To investigate the detail molecular mechanism of the interaction between DNA and cationic surfactant. As it is not clear still today whether the interaction is driven by adsorption of cationic surfactant monomers to the phosphate groups of DNA through static charge-charge attraction or by the interaction of multiple charged surfactant aggregates with DNA phosphates.</i> 4. <i>Also to detect the detail mechanism of de-complexation of DNA-cationic surfactant complex with the addition of oppositely charged molecules including surfactants and environmental alterations.</i> 	
<u>Date of Start:</u> 01/12/2013	Total cost of Project: Rs. 18,42,000/-
<u>Date of Completion:</u> 30/11/2016	Expenditure as on 31st November, 2016: Rs. 17,94,081/-
5. <u>Methodology:</u> <ol style="list-style-type: none"> i) <i>Surfactants and lipids are amphiphilic bodies, during their interaction with DNA, surface tension of solution will change. This will be measured with a tensiometer. Interaction will as well affect the configuration of the biopolymer in solution that will affect the viscosity. Its measurement will give idea on the configurational changes; DNA will be more compact and globular. Information of binding of ionic (cationic) surfactant can be also verified by conductance measurements. The above methods will also be used (along with others) to study the decompaction of the DNA-surfactant/lipid complex.</i> ii) <i>To study the stability or disstability (melting) of DNA, spectrophotometric and viscosity method will be used. There will be also scope to study the interaction of photoactive compounds with DNA in varying mole ratios. In vitro interaction and DNA compaction will be studied employing the above mentioned methodologies. Decompaction and release of DNA from the complexing agent will also be attempted to detect photometrically.</i> <p><i>Additional methods like Circular Dichromism, DLS, Confocal microscopy as required will be performed.</i></p>	
6. <u>Salient Research Achievements:</u> <i>As the beginning of this new study in area of compaction-</i>	

decompaction of DNA using surfactant and lipids, ct-DNA is used first. We have attempted compaction-decompaction from different angles using varieties surfactants. And have got excellent results of compaction of ct-DNA using cationic surfactants of quaternary ammonium salts. To release the bound cationic surfactant anionic surfactants are used. And it reflected a good extent of decompaction of DNA.

6.1 Summary of Project: In the three years from December'13 to November'16 good extents of work have been done. Initially started with Calf Thymus DNA (ct-DNA) and its compaction with well known cationic surfactant CTAB have been done. That compacted DNA was decompacted efficiently with anionic SDS. This first reporting of decompaction is published in Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy, ELSEVIER.

After getting the desired results with standard CTAB and SDS, we have attempted a same with surfactant of aromatic head group Cetylpyridinium bromide (CPB) as ct-DNA compacting agent and SDBS (Sodium dodecylbenzylsulfonate) has been used as decompating agent. This study has been published recently in Journal of Surfactant and Detergent, Wiely.

Last year we have attempted the same compaction-decompaction study using surfactants of different head groups OTAB, DTAB as ct-DNA compacting agent and SDS as decompating agent. This work has been comunicated.

6.2 New Observations: Till now CTAB gives best result in compacting ct-DNA and simultaneously SDS efficiently decompact that DNA to free the bound CTAB. Effect of chain length and effect of head groups of surfactants are under this study.

6.3 Innovations: Anionic surfactant can efficiently release the bound cationic surfactant from DNA in aqueous medium of pH 7.

6.4 Application Potential:

6.4.1 Long Term :

1. *DNA being a polyanion, the study and application of transfection carriers have been focused mainly upon cationic polymers and cationic amphiphiles or cationic surfactants, which act by partially neutralizing the surface charge of DNA, thus facilitating the transport of the DNA-carrier complex through the cell lipid bilayer.*
2. *This interaction is of great importance from biological and medical perspectives because cationic colloidal systems are known not only as DNA purifiers by condensation and precipitation but also as nonviral vehicles for gene transfer processes, capable of delivering genetic material to the patient's cells.*
3. *Thus lipoplexes (liposome or vesicle/DNA complexes) and surfoplexes (micelle/DNA complexes) have widely demonstrated their capability to compact the negatively charged polyelectrolyte by means of a strong surface electrostatic interaction, with the release of the counterions playing also an important entropic role.*
4. *DNA compaction is now a days actively studied for its relevance in the transport of DNA and other nucleic acids through the cell membrane for in vitro and in vivo gene delivery.*
5. *An important aspect of nucleic acid transfection is the ability to release the transfected DNA fragment within the cell, i.e. decompaction from the carrier. A strong binding to the carrier may disturb its further processing by the nuclear machinery, so by changing the pH within the physiological range or by using decomplexing agent another amphiphilic body or surfactant, decompaction is still a challenge for both in vitro and/or in vivo approach.*

6.4.2 Immediate: *Publication of research output as valuable experimental bench work.*

6.5 Any other: NA

7. Research work which remains to be done under the project (for on-going projects):

As the aim of project is reached now we shall try for a wide variety of surfactant series. The work will be done with surfactants of Nitrogen, Phosphorus and Sulfur containing head group also. Beside that interactions with different lipids will also be done. Other DNA will also be used in this study. Then the in depth interpretation for in-vivo study will be done.

Ph.Ds Produced no:	Technical Personnel trained:	Research Publications arising out of present project
Nil	One	1. "Internal Charge transfer based ratiometric interaction of anionic surfactant with calf thymus DNA bound cationic surfactant: Study I" A. Mukherjee, T. Chaudhuri, S. P. Moulik and M. Banerjee, <i>Spectrochim Acta A, 152 (2016) 1 - 7.(copy attached)</i> 2. "Ratiometric interaction of anionic surfactant with calf thymus DNA bound cationic surfactant: Study II" T. Chaudhuri, A. Pan, S. Das, A. Karmakar, and S. P. Moulik, <i>Journal of Surfactant and Detergent, doi: 10.1002/jsde.12016</i>

List of Publications from this Project (including title, author(s), journals & year(s))

(A) Papers published only in cited Journals (SCI):

1. "Internal Charge transfer based ratiometric interaction of anionic surfactant with calf thymus DNA bound cationic surfactant: Study I" A. Mukherjee, T. Chaudhuri, S. P. Moulik and M. Banerjee, ***Spectrochim Acta A, 152 (2016) 1 - 7.***

2. "Ratiometric interaction of anionic surfactant with calf thymus DNA bound cationic surfactant: Study II" T. Chaudhuri, A. Pan, S. Das, A. Karmakar, and S. P. Moulik, ***Journal of Surfactant and Detergent, doi: 10.1002/jsde.12016.***

(B) Papers published in Conference Proceedings, Popular Journals etc.: "Interaction of Biopolymers with Surfactants and Lipids: Photophysical and Electrochemical Study" A. Mukherjee and T. Chaudhuri, in Conference proceedings, "Chemistry for better Tomorrow - Current trends and opportunity" at S.K.B. University, Purulia.

Patents filed/ to be filed: NA

Major Equipment (Model and Make)					
Sl. No.	Sanctioned List	Procured (Yes/No) Model/Make	Cost (Rs. In Lakhs)	Working (Yes/No)	Utilisation (Rate %)
1.	Digital Balance	Afcoset (ER200)	0.58000	Yes	100
2.	Sonicator	Takashi Electric Co. Ltd.	0.54823		
3.	Tentiometer	Jencon India (local made)	0.64475		
4.	UV spectrophotometer with local circulatory water bath	Shimadzu (UV 1800) with local circulatory water bath	5.50200		