



Holy Cross College (Autonomous) Nagercoil – 629 004

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SSR
2019-2020
to
2023-2024

3.1.3 Percentage of teachers receiving national/ international fellowship/financial support by various agencies for advanced studies/ research

FELLOWSHIP COMPLETION DOCUMENTS

Dr. P. Aji Udaya



Indian Academy of Sciences, Bengaluru
Indian National Science Academy, New Delhi
The National Academy of Sciences India, Allahabad
Summer Research Fellowship Programme - 2024

Duration: 24th April – 18th June, 2024

**Synthesis and characterization of alkali metals co doped CaZrO₃: Eu³⁺
Phosphors for solid state lighting applications**

Final Report

Under the supervision of

Dr. C. Shivakumara

Principal Research Scientist



Solid State and Structural Chemistry Unit
Indian Institute of Science, Bengaluru - 560012

Submitted by

Dr. P. Aji Udhaya

(PHYT53)

Assistant Professor in Physics



Holy Cross College (Autonomous),

Nagercoil – 629004

June 2024





Indian Academy of Sciences, Bengaluru
Indian National Science Academy, New Delhi
The National Academy of Sciences India, Prayagraj
SUMMER RESEARCH FELLOWSHIPS — 2024

Format for the final Report

Name of the candidate : Dr. P. AJI UDHAYA

Application Registration no : PHY153

Date of joining : 24.04.2024

Date of completion : 18.06.2024

Total no. of days worked : 56

Name of the guide : Dr. C. SHIVAKUMARA

Guide's institution : INDIAN INSTITUTE OF SCIENCE, BENGALURU

Project title : Synthesis and characterization of alkali metal ion doped $\text{CaZrO}_3:\text{Eu}^{3+}$ Phosphors for solid state lighting applications

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TA Form attached with final report : YES NO

If, NO, Please specify reason _____

Signature of the candidate: P. Aji Udhaya
 Date: 18.06.2024

Signature of the guide: C. Shivakumara
 Date: 18-06-2024

IMPORTANT NOTES:
 * This format should be the first page of the report and should be stapled with the main report. The final report could be anywhere between 20 and 25 pages including tables, figures etc.
 * The final report must reach the Academy office within 10 days of completion. If delayed the fellowship amount will not be disbursed.

Dr. C. SHIVAKUMARA, Ph.D.
 Principal Research Scientist
 Solid State Synthesis Chemistry Unit
 Indian Institute of Science
 Bangalore - 560 012, India

(For office use only; do not fill/tear)

Candidate's name	Fellowship amount:
Student Teacher	Deduction:
Guide's name	TA fare:
KVPY Fellow INSPIRE Fellow	Amount to be paid
PFMS Unique Code	A/c holder's name
Others	



Solid State and Structural Chemistry Unit
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Dr. C. SHIVAKUMARA, Ph.D.
Principal Research Scientist

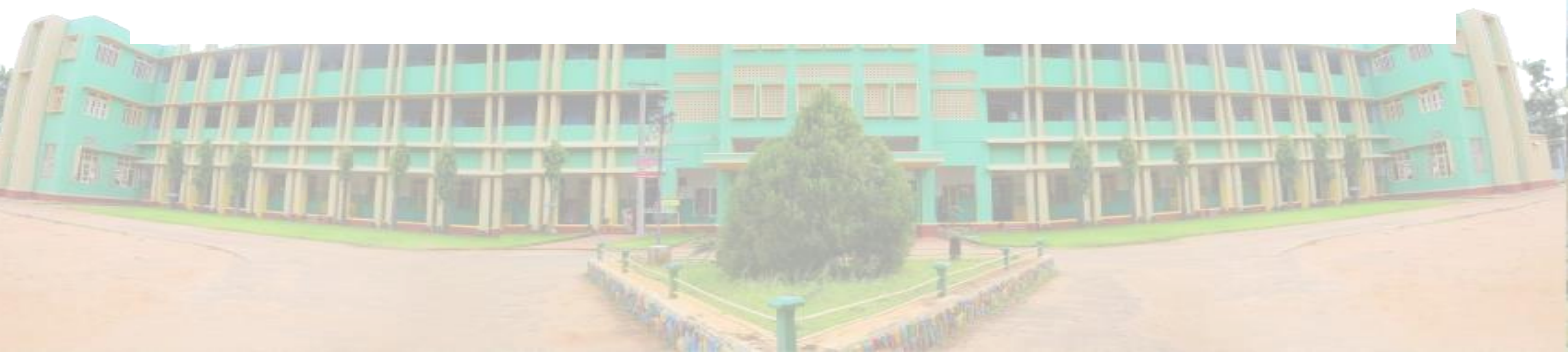
CERTIFICATE

This is to certify that Dr. P. Aji Udhaya, Assistant Professor in Physics, Holy Cross College (Autonomous), Nagercoil, has carried out her summer project work entitled "Synthesis and characterization of alkali metal ion co doped CaZrO_3 : Eu^{3+} Phosphors for solid state lighting applications" under my supervision from 24th April 2024 – 18th June 2024 at Solid State and Structural Chemistry Unit, Indian Institute of Science, Bangalore – 560012. The fellowship was sponsored by Indian Academy of Sciences – Bangalore, Indian National Science Academy – New Delhi and The National Academy of Sciences, Allahabad. To the best of my knowledge her character and conduct are good. I wish her all the best for her future endeavors.

Date: 18-06-2024


18/06/2024
Dr. C. Shivakumara

Dr. C. SHIVAKUMARA, Ph.D.,
Principal Research Scientist
Solid State & Structural Chemistry Unit
Indian Institute of Science
Bangalore - 560 012, India

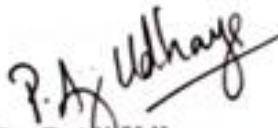


DECLARATION

Dr. P. Aji Udhaya (PHYT53)
Assistant Professor
Department of Physics
Holy Cross College (Autonomous)
Nagercoil

I hereby declare that the matter embodied in this project work entitled "Synthesis and characterization of alkali metals co doped $\text{CaZrO}_3: \text{Eu}^{3+}$ Phosphors for solid state lighting applications" are based on the work carried out by me under the supervision of Dr. C. Shivakumara, Principal Research Scientist in the Solid State and Structural Chemistry Unit, Indian Institute of Science, Bangalore – 560012, In keeping with the general practice of reporting scientific observations, due acknowledgement has been made wherever the work described is based on the findings of other investigations. Any omission, which might have occurred by oversight or error in judgements, is regretted.

Date: 18.06.2024


Dr. P. Aji Udhaya
(PHYT53)



Dr. M. Priya Dharsini

UTILIZATION CERTIFICATE

1. Name of the Scheme : Young Scientist Fellowship Scheme (YSFS)
2. Name and address of the YSFS Awardee : **Dr. M. Priya Dharshini**
Assistant Professor
Department of Physics,
Holy Cross College (Autonomous),
Nagercoil- 629004
3. Council Sanction letter details/reference : **Ref. No. TNSCST/YSFS/BS/11/2022-2023- 9395**
Dated 04.07.2023
4. Programme Venue , date etc., : **Department of Nanoscience and Nanotechnology,**
University of Kerala, Thiruvananthapuram -695581
04.10.2023 to 02.12.2023 (2 months)
5. Amount Sanctioned : **Rs. 21420/-**

CERTIFICATE

It is Certified that a sum of **Rs. 21420/-** sanctioned by the Council for the scheme "Young Scientist Fellowship Scheme (YSFS)" through the Council sanction letter **Rs. 20000/-** has been utilized for the purpose for which it was sanctioned as per the terms and conditions of the scheme and a sum of **Rs. 1420/-** remaining unutilized / the balance grant has been returned to the Council.


Signature of the YSFS Awardee


Head of the Institution
PRINCIPAL
Holy Cross College
(Autonomous)
Nagercoil - 629 004.



Report of Young Scientist Fellowship Scheme (YSFS) 2022-2023

Training on Learning Specific Techniques

Project entitled “Spectroscopic Analysis of Ni(OH)₂ Nanostructures synthesized by Hydrothermal Method for Electrochemical Applications”

Submitted to

TAMILNADU STATE COUNCIL FOR SCIENCE AND TECHNOLOGY

(An Autonomous body under Govt. of Tamilnadu)

DOTE Campus, Guindy, Chennai – 600 025.



TNSCST

by

Dr. M. Priya Dharshini (Ref. No. TNSCST/YSFS/BS/11/2022-2023)

Assistant Professor

Department of Physics,

Holy Cross College (Autonomous),

Nagercoil- 629004

SUPERVISOR OF THE HOST INSTITUTION:

Dr. I. Hubert Joe

Professor & Head, Department of Nanoscience and Nanotechnology,

University of Kerala, Thiruvananthapuram -695581



Report of Young Scientist Fellowship Scheme (YSFS) 2022-2023

Training on Learning Specific Techniques

Project entitled “Spectroscopic Analysis of Ni(OH)₂ Nanostructures synthesized by Hydrothermal Method for Electrochemical Applications”

Submitted to

TAMILNADU STATE COUNCIL FOR SCIENCE AND TECHNOLOGY

(An Autonomous body under Govt. of Tamilnadu)

DOTE Campus, Guindy, Chennai – 600 025.



TNSCST

by

Dr. M. Priya Dharshini (Ref. No. TNSCST/YSFS/BS/11/2022-2023)

Assistant Professor

Department of Physics,

Holy Cross College (Autonomous),

Nagercoil- 629004

SUPERVISOR OF THE HOST INSTITUTION:

Dr. I. Hubert Joe

Professor & Head, Department of Nanoscience and Nanotechnology,

University of Kerala, Thiruvananthapuram -695581





UNIVERSITY OF KERALA
(Re Accredited by NAAC with 'A++' Grade)

DEPARTMENT OF NANOSCIENCE AND NANOTECHNOLOGY

Date: 02.12.2023

Kariavattom
Thiruvananthapuram-695581
Kerala, India
Phone: 0471-2308863
nanotech.ku@gmail.com

Dr. I. Hubert Joe
HOD

CERTIFICATE OF PROJECT COMPLETION

This is to certify that **Dr. M. PRIYA DHARSHINI**, Assistant Professor, Department of Physics, Holy Cross College (Autonomous), Nagercoil completed the project entitled "Spectroscopic Analysis of $\text{Ni}(\text{OH})_2$ Nanostructures synthesized by Hydrothermal Method for Electrochemical Applications" under the Supervision of **Dr. I. Hubert Joe, Head, Department of Nanoscience and Nanotechnology, University of Kerala, Kariavattom, Thiruvananthapuram** for a period of **two months** under the **Young Scientist Fellowship Scheme 2022-2023** (Ref: TNSCST/YSFS/BS/11/2022-2023) which is awarded by the Tamil Nadu State Council for Science and Technology from 04-10-2023 to 02-12-2023 and is the original work done by her.

Signature of the Supervisor

Dr. I. HUBERT JOE
Prof & Head
Department of Nanoscience & Nanotechnology
University of Kerala
Kariavattom, Trivandrum - 695 581

Place: *Thiruvananthapuram*

Date: *02.12.2023*




Dr.M. Priya Dharshini (Ref. No. TNSCST/YSFS/BS/11/2022-2023)
Assistant Professor
Department of Physics,
Holy Cross College (Autonomous),
Nagercoil- 629004

DECLARATION

I hereby declare that the investigation reported in this project work is entirely original and have been carried out by me in the Department of Nanoscience and Nanotechnology, University of Kerala, Thiruvananthapuram under the supervision and guidance of Dr. I. Hubert Joe, Professor & Head, Department of Nanoscience and Nanotechnology, University of Kerala, Thiruvananthapuram -695581.

Place: Nagercoil
Date:02-12-2023


Signature of the candidate



ACKNOWLEDGEMENT

First of all I express my profound gratitude to **my Lord Almighty**, who has been the source of inspiration for all my achievements.

It is my privilege to express my sincere thanks and gratitude to my supervisor, **Dr. Hubert Joe**, Professor and Head, Department of Nanoscience and Nanotechnology, University of Kerala, Thiruvananthapuram for his skillful guidance, systematic supervision and encouragement to accomplish the noble task of completing this project.

I express my sincere gratitude to my Research Guide **Dr.Sr.Gerardin Jayam**, the Secretary **Dr. Sr. Mary Hilda**, and the Principal **Dr. Sr. Sahayaselvi**, Holy Cross College (Autonomous), Nagercoil for their encouragement and motivation in completing the research fellowship.

Also, I extend my thanks to the Head of the Department of Physics **Dr.C. Nirmala Louis**, Holy Cross College (Autonomous), Nagercoil, my colleagues and friends. I am extremely grateful to my family members and all my well-wishers for their support in the successful completion of work.

M.Priya Dharshini



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Abstract

The development of nickel-based electrode materials has always been an important role in the field of electrochemical energy. It is well known that nickel hydroxide has been well applied in supercapacitors, which can further be employed as a precursor to fabricate other nickel-based compounds and their composites as electrode materials. During the process of continuous development of materials science, the research and development of new processes for material preparation and synthesis has always been an important part. For a long time, researchers have been searching for a material synthesis method with limited pollution, easy operation, excellent product performance, and low production cost. The synthesis methods of inorganic powder materials mainly include the solid phase, liquid phase, and gas phase methods. The solid phase method results in a high yield and is easy to realize for large-scale industrial production. However, because of the limitations of the equipment and the process itself, it is difficult to control the particle size, purity, and morphology of powder using the solid phase method. The liquid phase method mainly includes the precipitation, hydrothermal, colloidal, and sol-gel methods. In this work, the controllable growth and phase transformation of Ni(OH)₂ have been successfully achieved through a traditional mild hydrothermal route by effective concentration of reactants. The structural and optical studies of the as-synthesized Ni(OH)₂ nanoparticles are carried out through PXRD and PL respectively.



Dr. A. Lesly Fathima



Indian Academy of Sciences, Bengaluru
 Indian National Science Academy, New Delhi
 The National Academy of Sciences India, Prayagraj
SUMMER RESEARCH FELLOWSHIPS – 2021
Format for the Final-week Report*

Name of the candidate : A. Lesly Fathima

Application Registration no. : PHY.T.3

Date of Commencement of work : 24.05.2021

Mode of work : From Home: Guide's Laboratory:

Date of completion : 04.08.2021

Total no. of days worked : 70 days

Name of the guide : Dr. R.B. Rakhi

Guide's institution : University of Kerala, Trivandrum

Project title : A review on recent advances in
Electrode materials for supercapacitors

Address with pin code to which the certificate could be sent:
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Holy Cross College, Nagercoil, Tamil Nadu - 629004
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 Phone No: 7598473275

TA Form attached with final report (not applicable for those working from home) : YES NO

If, NO, Please specify reason : Working from home

Signature of the candidate : A. Lesly Fathima
 Date: 04.08.2021

Signature of the guide : _____
 Date: _____

*The final report could be anywhere between 20 and 25 pages including tables, figures etc.
 This format should be the first page of the report and should be stapled with the main report.

(For office use only; do not fill/tear)

Candidate's name:		Fellowship amount:
Student:	Teacher:	Deduction:
Guide's name:		TA fare:
KVPY Fellow:	INSPIRE Fellow:	Amount to be paid:
PFMS Unique Code:		A/c holder's name:
Others:		

A REVIEW ON RECENT ADVANCES IN ELECTRODE MATERIALS FOR SUPERCAPACITORS

Dr.A. Lesly Fathima, Ph.D

Assistant Professor of Physics,
Holy Cross College (Autonomous),
Nagercoil

Guided by

Dr. Rakhi Raghavan Baby, Ph.D

UGC-Assistant Professor & Ramanujan Fellow
Department of Physics
University of Kerala

1. Introduction

The ever increasing cost of fuels, global warming and pollution are the vital problems connected with the usage of fossil fuels. Reducing these issues leads to the development of other energy sources and energy storage techniques. As a result, a growing interest in high energy and power density storage systems arises among the researchers. Energy storage systems are the solution to deal with the intermittent nature of renewable energy sources. Clean energy technologies such as electrochemical energy storage and energy conversion are the most feasible and sustainable. Electrochemical energy technologies such as fuel cells, supercapacitors and batteries have been utilized in various applications including transportation and stationary micro power.



Dr. S. Sonia

**STRUCTURAL AND IMPEDANCE SPECTROSCOPIC
ANALYSES OF $\text{Ca}_4\text{Bi}_6\text{O}_{13}$**

Eight Week Project Report

11.05.2020 to 11.07.2020

Submitted to



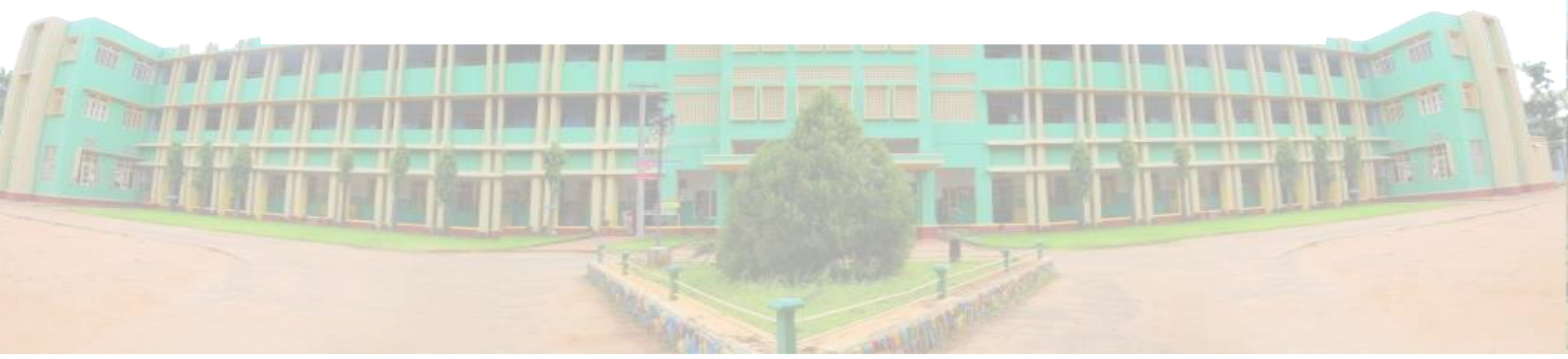
Indian Academy of Sciences
C.V. Raman Avenue
Bangalore
(Summer Research Fellowship-2020)

By

Dr. S. SONIA (Reg.No. PHYT110)
Summer Research Fellow
BARC, Mumbai

Under the supervision of

Dr. S. N. ACHARY
Scientific Officer (H), Chemistry Division
BARC, Mumbai



CERTIFICATE

This is to certify that Dr. S. Sonia, Assistant Professor of Physics, Holy Cross College (Autonomous), Nagercoil, has completed her Summer Research Project work from home option on "Structural and Impedance Spectroscopic Analyses of $\text{Ca}_4\text{Bi}_6\text{O}_{13}$ " under my supervision during the period from 11th May 2020 to 11th July 2020.

Signature _____ *S. N. Achary* 09-09-2020

Name & Designation _____ Dr. S. N. Achary _____

डॉ. एस.एन. आचार्य / Dr. S. N. Achary
अध्यक्ष, नाभिकीय एवं ऊर्जा पदार्थ अनुभाग /
Head, Nuclear & Energy Material Section
रासायनिकी विभाग / Chemistry Division
बी.ए.अर.सी. / B.A.R.C.

Division/Unit: _____ Chemistry Division, BARC, Mumbai-85, India _____

ट्रॉम्बे, मुंबई-400085 / Trombay, Mumbai-400085

ACKNOWLEDGEMENT

"Give Thanks to the Lord for He is Good"

At first, I owe my profound gratitude to Almighty God for his endless grace, love and blessings showered upon me for completion of the project successfully.

I express my thanks to our secretary Dr. Sr. Gerardin Jayam, the principal Dr. Sr. Anne Perpet Sophy for their moral supports and encouragements.

With deep sense of gratitude, I express my gratefulness to Indian Academy of sciences for selecting me as summer research fellow and providing the opportunity to do project at home.

I respect and extremely grateful to my project guide Dr. S. N. Achary, Scientific Officer (H), Chemistry Division, BARC, Mumbai, for giving me an opportunity to do the project work in Theoretical Physics, and providing me all constant support and valuable source to complete the project on time.

I am thankful and fortunate enough to get encouragement and valuable support from my family members and those who have helped me to complete my research work successfully.

Dr. S. SONIA



Structural and Impedance Spectroscopic Analyses of $\text{Ca}_4\text{Bi}_6\text{O}_{13}$

Abstract

This report gives the results on structural and impedance analysis studies on $\text{Ca}_4\text{Bi}_6\text{O}_{13}$ as summer project work during the period of 11.05.2020 to 11.07.2020. The structural analyses were carried out by Rietveld refinement program and the impedance analyses were carried out by analyzing the complex impedance spectra. Rietveld refinements were carried out using Fullprof program through the Win Plotr interface. Three bismuth atoms (Bi1, Bi2 and Bi3), one calcium atom (Ca1) and five oxygen atoms (O1, O2, O3, O4 and O5) and orthorhombic (Space group: $C2mm$) were considered to refine the XRD data of $\text{Ca}_4\text{Bi}_6\text{O}_{13}$. The structural parameters such as unit cell dimensions (a, b, c), position coordinates were refined and the goodness of fits were judged from the reliability factors and difference plots. The temperature dependent electrical conductivity was found to follow Arrhenius relation. The complex impedance spectra were analyzed using parallel RC circuit. The variation of conductivity with temperature follows Arrhenius behavior and the activation energy of electrical conduction is 1.047 eV.

Introduction

Bismuth containing oxides have wide technological relevant properties ranging from super-capacitors, gas sensors, IT-SOFC, solar cells, photocatalysts, semiconductor, superconductors etc. Also, due to high carrier mobility, low effective mass and long mean free path of Bi based materials make them promising photocatalytic materials. Addition of Bi into the semiconducting compounds increases the visible light absorption and so effective electron-hole recombination suppression. Bi (III) and Bi (V) containing materials are more sensitive for visible light. Thus, the bismuth-based semiconductors seem to be a good option for photocatalysis. Several reports on semiconductors like BiVO_4 , CaBi_2O_4 , BiFeO_3 , NaBiO_3 , KBiO_3 , etc. showing good photocatalytic activity and stability for the degradation of organic compounds are available in literature. Also, the asymmetric electron density of Bi^{3+} ions in aqueous solution results different morphologies of metal oxides with wide varieties of micro-structures. Bismuth oxyhalides are used as excellent absorbents in water purification system. Heterometallic oxides with Bi are also



Dr. Jeni Chandar Padua

Report of Research work conducted as part of
The Indian Science Academies' Research Fellowship-2019 at
The CSIR-Centre for Cellular and Molecular Biology, Hyderabad

Targeted editing of the Ubx, abd-A and Abd-B genes in *Drosophila melanogaster*, using CRISPR/Cas9 gene editing.

Indian Science Academies' Research Fellow:

Dr. JENI CHANDAR PADUA

Assistant Professor, Department of Zoology,
Holy Cross College, Nagercoil, Kanyakumari District,
Tamil Nadu-629004.

Guide:

Dr. RAKESH. K. MISHRA

Director, CSIR- Centre for Cellular and Molecular Biology,
Uppal Road, Habsiguda, Hyderabad, Telangana 500007

Abstract

The Bithorax complex (BX-C) in *Drosophila melanogaster* is one of the two Hox Complexes which are responsible for developing the posterior 2/3rd of the body axis of the fly. Influence of mutants on these Hox gene complexes, result in gene alterations causing homeotic transformation of body segments. In order to understand the segment/ tissue-specific localization, three genes of the BX-C, the Ubx, abd-A and Abd-B were tagged by means of CRISPR/Cas9 gene editing, as it introduces targeted genome alterations with unprecedented precision, using transgenic CRISPR components which mediate targeted mutagenesis in the fly genome. This CRISPR/ Cas9 system is used to *knock-in* genes with the help of a single guide RNA which is generated to direct the Cas9 nuclease to a specific genomic location following which the Cas9-induced double-strand breaks are repaired. The expression of the Hox genes in *Drosophila melanogaster* is the focus of this study and has been designed to perform gene-editing in *Drosophila* using CRISPR/Cas9. Primers were designed and synthesized. Desired clones for tagging were generated and micro-injected in *Drosophila* embryos to generate transgenes.



Keywords : CRISPR/Cas9, genomic engineering, transgenic flies, eukaryotic gene regulation, Hox Complexes

INTRODUCTION

Drosophila melanogaster is an important model for understanding body plan generation and evolution. The general principles of Hox gene function and logic elucidated in flies will apply to all bilaterian organisms, including humans. *Drosophila* has eight Hox genes. These are clustered into two complexes, both of which are located on chromosome 3. The Antennapedia complex (not to be confused with the *Antp* gene) consists of five genes: labial (*lab*), proboscipedia (*pb*), deformed (*Dfd*), sex combs reduced (*Scr*), and Antennapedia (*Antp*). The Bithorax complex, named after the Ultrabithorax phenotype, consists of the remaining three genes: Ultrabithorax (*Ubx*), abdominal-A (*abd-A*) and Abdominal-B (*Abd-B*) (Hughes and Kaufman, 2002). The Hox genes which are a subset of homeobox genes, that specify regions of the body plan of an embryo along the head-tail axis of animals, encode and specify the characteristics of 'position', ensuring that the correct structures form in the correct places of the body. In many animals, the organization of the Hox genes in the chromosome is the same as the order of their expression along the anterior-posterior axis of the developing animal, and are thus said to display spatial colinearity (Pearson *et al.*, 2005; Carroll, 1995).

In this study, three genes of the BX-C, the *Ubx*, *abd-A* and *Abd-B* were tagged by gene editing, to introduce genome alterations, using transgenic CRISPR components which mediate targeted mutagenesis in the fly genome. The Hox gene expressions in *Drosophila melanogaster* is the focus of this study and has been designed to perform gene-editing in *Drosophila* embryos using micro-injections to generate transgenes.

OBJECTIVES OF THE RESEARCH WORK

1. Preparation of the genomic DNA:
2. Designing the primer
3. PCR Amplification of BX- C genes from gDNA and reporters from vector
4. Overhang PCR of *abd-A* and *Abd-B* donor constructs



ACKNOWLEDGEMENT

I would like to place on record my sincere gratitude to my guide Dr. Rakesh K Mishra, for his immense support and for providing the right facilities and infrastructure necessary for carrying out research in *Drosophila*. I would also like to thank Mr. Nikhil Hajirnis, for his excellent mentoring and for helping me in carrying out the PCR and CRISPR/CAS9 techniques and for helping me out to carry out this fellowship in the right way. I thank Dr. Rashmi for making all the arrangements necessary for my research fellowship at CCMB. I thank Dr. Runa for helping me understand behavioral assays, isogenisation procedures and immunostaining procedures. I thank Dr. Sonal for giving me necessary help and support during my research tenure. I also thank Dr. Bharathi, for helping me with instrumentation and fluorescence microscopy. I thank all my lab-mates, technicians, friends and fellow-researchers for their love and support, especially for making my tenure at CSIR-Centre for Cellular and Molecular Biology, Hyderabad, a memorable one.

Signature of the IAS Research Fellow:



Dr. Jeni Chandar Padua,
Indian Academies Research Fellow (LFT 59).

