



HAFFKINE INSTITUTE

For Training Research and Testing

An Autonomous Institute of Govt. of Maharashtra Registered under Societies Registration Act 1860

Recognised as Scientific & Industrial Research Organisation (SIRO) by Ministry of Science & Technology Govt. of India.



ANNUAL REPORT

2020-2021 and 2021-2022

ANNUAL REPORT

2020-21 and 2021-22



HAFFKINE INSTITUTE FOR TRAINING, RESEARCH & TESTING

Acharya Donde Marg, Parel, Mumbai 400 012.
www.haffkineinstitute.org

(Revamped under Mahat)

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Director's Desk



**Ms. Seema Vyas (IAS),
Director,
Haffkine Institute**

Greetings from Haffkine Institute!!

It gives me immense pleasure as a director of this prestigious institute to present to you the annual report of the institute for the year 2020-21 and 2021-22.

Haffkine Institute is one of the oldest biomedical research institutes in the country and over the years, it has evolved as a centre for multidisciplinary research with public health at its focus. We are committed towards the serving the welfare of humans by means of ameliorating and alleviating sufferings, providing holistic measures to research, prevention, treatment and education in biomedical and allied fields of science.

Through this annual report, I would like to highlight the research, training and testing activities of the all department of institute and also to convey the achievements made by each department in their domain.

Looking at the dedication and commitment of the staff of the institute, I am confident that the staff of the Haffkine Institute will be ready to face new challenges in the next year. Also their whole hearted participation in the Institute's research, training & testing activities will help in achieving the goal to become one of the finest research Institutes in the country and in the world. I wish all the best to Haffkine staff and students for their future endeavors.

GOVERNING COUNCIL

2020-21

1	Shri. Amit Deshmukh Hon. Minister, Medical Education Government of Maharashtra Mantralaya, Mumbai 400 032	President
2	Shri. Rajendra Yadravkar Hon. Minister of State, Medical Education Government of Maharashtra Mantralaya, Mumbai 400 032	Vice – President
3	Dr. Sanjay Mukharjee, IAS Secretary Medical Education & Drugs Department Government of Maharashtra Mantralaya, Mumbai 400 032 (Period 01-04-2020 to 26-07-2020)	Member
	Shri. Saurabh Vijay, IAS Secretary Medical Education & Drugs Department Government of Maharashtra Mantralaya, Mumbai 400 032 (Period 27-07-2020 to 31-03-2021)	Member
4	Dr. Abhimanyu Kale, IAS Commissioner Food & Drugs Administration Bandra-Kurla Complex Bandra (E), Mumbai 400 051	Member
5	Dr. Tatyrao P. Lahane, Director Medical Education & Research Government of Maharashtra St. George's Hospital Campus, Mumbai 400 001	Member
6	Dr. Jagdish Prasad, Director General of Health Services, Government of India, R.N. 444, 'A' Wing, Nirman Bhawan, New Delhi – 110108.	Member
7	Dr. Rajesh Deshmukh, IAS Director, Haffkine Institute for Training, Research and Testing, Parel, Mumbai – 400 012. (Period 01-04-2020 to 23-08-2020)	Member - Secretary
	Smt. Shaila A., IAS Director, Haffkine Institute for Training, Research and Testing, Parel, Mumbai – 400 012. (Period 24-08-2020 to 30-09-2020)	Member - Secretary
	Smt. Seema Vyas, IAS Director, Haffkine Institute for Training, Research and Testing, Parel, Mumbai – 400 012. (Period 01-10-2020 to 31-03-2021)	Member - Secretary

GOVERNING COUNCIL		
2021-22		
1	Shri. Amit Deshmukh Hon. Minister, Medical Education Government of Maharashtra Mantralaya, Mumbai 400 032	President
2	Shri. Rajendra Yadravkar Hon. Minister of State, Medical Education Government of Maharashtra Mantralaya, Mumbai 400 032	Vice – President
3	Shri. Saurabh Vijay, IAS Secretary, Medical Education and Drugs Department, Government of Maharashtra, Mantralaya, Mumbai – 400 032.	Member
4	Shri. Abhimanyu Kale, IAS Commissioner, Food and Drugs Administration, Bandra-Kurla Complex, Bandra (E), Mumbai – 400 051. Email- comm.fda-mah@nic.in (Period 01-04-2021 to 20-24-2021)	Member
	Shri. Parimal Singh, IAS Commissioner, Food and Drugs Administration, Bandra-Kurla Complex, Bandra (E), Mumbai – 400 051. Email- comm.fda-mah@nic.in (Period 20-04-2021 to 31-03-2022)	Member
5	Dr. Dilip Mhaisekar Director, Medical Education and Research, Government of Maharashtra, St. George's Hospital Campus, Mumbai – 400001. Email- dmerps@gmail.com	Member
6	Dr. Sunil Kumar Director General of Health Services, Government of India, Room No. 444, 'A' Wing, Nirman Bhawan, New Delhi – 110108.	Member
7	Smt. Seema Vyas, IAS Director, Haffkine Institute for Training, Research and Testing, Parel, Mumbai – 400 012.	Member - Secretary

EXECUTIVE COMMITTEE

2020-21

1	Smt. Seema Vyas, IAS Director, Haffkine Institute for Training, Research and Testing, Parel, Mumbai – 400 012.	Chairperson
2	Dr. Shashikant P. Vaidya Asst. Director and HOD, Department of Clinical Pathology Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
3	Mrs. Suvarna Pachpore Senior Scientific Officer and HOD, Department of Chemical Testing, Haffkine Institute for Training, Research and Testing, Haffkine Institute, Parel, Mumbai - 400 012.	Member
4	Dr. Usha Padmanabhan Senior Scientific Officer and HOD, Department of Biochemistry and Cell Biology Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
5	Dr. Anuya Rege Senior Scientific Officer and HOD, Department of Bacteriology, Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
6	Dr. Mrunal Ghag-Sawant Scientific Officer and HOD Venomous Animal Unit, Zoonosis Dept. and Toxicology Dept. Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
7	Dr. Sandeepan Mukherjee Scientific Officer and HOD, Department of Virology Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
8	Dr. Ashish Asrondkar Scientific Officer and HOD, Department of Chemotherapy Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
9	Dr. Vrushali Patil Scientific Officer and Incharge Department of Training Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
10	Smt. Trupti Talavadekar Accounts Officer, Accounts Department Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
11	Shramik Utkarsha Sabha President/Secretary, (Workers' Union Representative)	Member
12	Dr. Usha Padmanabhan Chief Administrative Officer, Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member - Secretary

EXECUTIVE COMMITTEE		
2021-22		
1	Smt. Seema Vyas, IAS Director, Haffkine Institute for Training, Research and Testing, Parel, Mumbai – 400 012.	Chairperson
2	Dr. Shashikant P. Vaidya Asst. Director and HOD, Department of Clinical Pathology Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
3	Mrs. Suvarna Pachpore Senior Scientific Officer and HOD, Dept. of Chemical Testing, Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
4	Dr. Usha Padmanabhan Senior Scientific Officer and HOD, Department of Biochemistry and Cell Biology Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
5	Dr. Anuya Rege Senior Scientific Officer and HOD, Department of Bacteriology, Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
6	Dr. Mrunal Ghag-Sawant Scientific Officer and HOD Venomous Animal Unit, Zoonosis Dept. and Toxicology Dept. Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
7	Dr. Sandeepan Mukherjee Scientific Officer and HOD, Department of Virology Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
8	Dr. Ashish Asrondkar Scientific Officer and HOD, Department of Chemotherapy Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
9	Dr. Vrushali Patil Scientific Officer and Incharge Department of Training Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member
10	Smt. Trupti Talavadekar Accounts Officer, Accounts Department Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012. (Period 01-04-2021 to 30-09-2021)	Member
	Smt. Priyanka Ghag I/C Accounts Officer, Accounts Department Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012. (Period 01-10-2021 to 31-03-2022)	Member
11	Shramik Utkarsha Sabha President/Secretary, (Workers' Union Representative)	Member
12	Dr. Usha Padmanabhan Chief Administrative Officer, Haffkine Institute for Training, Research and Testing, Parel, Mumbai - 400 012.	Member - Secretary

Administration

2020-21 and 2021-22



Dr. Shashikant Vaidya

Additional Charge as
Chief Administrative Officer
02/06/2020-16/02/2021



Dr. Usha Padmanabhan

Additional Charge as
Chief Administrative Officer
17/02/2021-31/03/2022

Overview

As per Memorandum of Association, the Minister, Medical Education, Government of Maharashtra is Ex-Officio president of the Governing Council and Minister of State, Medical Education is ex-officio Vice-President of the Governing Council. The Governing Council meets once/twice a year and given direction for smooth functioning and progress of the Institute. All other members of the governing council are Ex-Officio members of Government of Maharashtra like Secretary, Medical Education, Director, Medical Education Commissioner, Food and Drugs Administration and a representative from Health department, Government of India, which is considered to be a think tank of the Institute. Apart from this supreme body of the institute, Executive Committee (Administration) meets regularly to execute the decisions of Governing Council and also take decision in local issues. All the decision with financial implications is discussed in the executive committee. The said decisions are then ratified by the Governing Council found fit.

Administration Department maintains personal records of all the staff members. It also maintains record of all the Scientist and Students and caters to the need of various departments for smooth functioning of the Institute. All the Correspondence received in the institute is routed through the Department. Maintenance of facilities like digital communication is done by Admin. Liaisoning with PWD civil as well as an Electrical helps other department functioning smoothly. After ISO audit the record maintenance system has been improved.

Accounts Section which works under Administration Department also maintains all the books of accounts of the Institute in electronic format. It also maintains records of all the grants received by the Institute for various research project from ICMR, IDSP, DBT and DST, apart from grant in aid received from the Government of Maharashtra. All the accounting is done digitally by accounting software, which facilitates monitoring institute's financial position. Though the payment of salary to staff is received from Treasury office, Thane through Directorate of Ayurveda, the pay bills are prepared and record is maintained at the Institute level. Stores Section which also function under Administration Department, procures all consumables, chemical, reagents, plasticware and glassware items and distributes to all the departments as per their requirements. It also procures all the local and imported Scientific Instruments for various departments of the Institute. The Store department also ensures maintenance of Instruments. Civil and electrical maintenance of the Institute is done by P.W.D, Government of Maharashtra.

Chief Administrative Officer



Research

Research Projects

1. Establishment of facility for venom and ASV characterization

Funding Agency - BIRAC (Biotechnology Industry Research Assistance Council),
DBT (Dept. of Biotech)

Budget - Rs. 47.95 lac

This project is completed.

2. Establishment of National Venom Research Centre in Haffkine Institute

Funding Agency - DHR (Department of Health Research), New Delhi

Budget - Rs. 24.28 CR

This Project is in Progress.

3. NCDC: Regional Coordinator on National One Health Program for Prevention and Control of Zoonosis

Funding Agency - NCDC, New Delhi

Budget – Rs. 24,00,000/-

Duration - January 2020 till present

This Project is in Progress.



Bacteriology

Bacteriology

2020-21 and 2021-22



Dr. Shashikant Vaidya

Head of the Department
(03/03/2020-17/12/2020)



Dr. Anuya Rege

Head of the Department
(18/12/2020-31/03/2022)

Overview

Department of Bacteriology is the oldest department of the Haffkine Institute. Since its beginning, the department has been involved in research to tackle problems of immediate concern to public health. In 1896, plague broke out in Bombay in an epidemic form. Dr. Haffkine was invited by the Government to investigate the causes of the plague epidemic and to develop a prophylactic. He started his work in one of the rooms of the Petit Laboratory of Grant Medical College and this was the beginning of the Department of Bacteriology, with the main function of producing plague vaccine. In the year 1947, the Department of Bacteriology- then known as 'Vaccine Department'- supplied 23.5 million ml of plague vaccine, the highest in the history of the Institute. Department gradually undertook the production of Cholera and T.A.B. vaccines. "The year 1963 saw the historic peak" of supply of 23.5 million ml. of cholera vaccine.

Currently, it provides testing facilities for carrying out Bacteriological examination of water samples from various industrial and household sources. Testing of water purifying systems includes UV-based, RO-based, and membrane filter-based water purifiers. Besides, departmental testing activities also involve antimicrobial efficacy testing of sanitizers, disinfectants, antimicrobial coated/incorporated material as well as synthetic and herbal preparations. Furthermore, department provides guidance and Research facilities to M.Sc./Ph.D. candidates and "Short Term Research Interns (STRIP students)"

Department would like to initiate research projects on Antibacterial & Antifungal activities of natural products and to study effect of natural products on Microbial Biofilms in near future.

COVID Testing (2020-2021):

1. Staff of Department of Bacteriology was actively involved in testing of Novel Corona Virus (COVID-19) samples especially Aliquoting and RNA Extraction of samples. [Dr. Anuya Rege (Senior Scientific Officer), Mrs. Amita Patil (Scientific Officer) and Mrs. Dipti Kolte (Senior Technical Assistant)]

2. Staff of Department of Bacteriology was actively involved in Data Entry work related to Novel Corona Virus (COVID-19) testing. [Dr. Anuya Rege (Senior Scientific Officer) and Mrs. Amita Patil (Scientific Officer)]
3. Staff of Department of Bacteriology was actively involved as support staff in general work related to Novel Corona Virus (COVID-19) testing. [Mr. Jitendra Dalvi (Laboratory Assistant), Mr. Ravindra Bire (Laboratory Assistant) and Mr. Sandip Kegde (Laboratory Attendant)]

Dr. Anuya Rege



Departmental Photograph

Research Projects

1. To determine Nutraceutical Potential and Antimicrobial Potential of Powder of Dried Hibiscus Flowers.

Team:

- Mr. Atsih Dongarkar (STRIP Student)
- Mrs. Suvarna Pachpore (Mentor, Chemical Testing Department),
- Mrs. Dipti Kolte (Bacteriology Department)
- Dr. Anuya Rege (Co-Mentor, Bacteriology Department).

Funding Agency: Haffkine Institute (STRIP Fee)

Duration: December 2021 – March 2022 (STRIP Batch- I)

Abstract

Introduction: Nutraceuticals, in broad, are food or part of food playing a significant role in modifying and maintaining normal physiological function that maintains healthy human beings. These nutraceuticals help in combating some of the major health problems of the century such as obesity, cardiovascular diseases, cancer, osteoporosis, arthritis, diabetes, cholesterol etc. In whole, 'nutraceutical' has led to the new era of medicine and health, in which the food industry has become a research-oriented sector. India is a rich source of Medicinal plants and called "Botanical Garden of World" with enormous wealth of Biodiversity. There are almost 45,000 plant species recorded in India so far of which 7,500 species have been used for medicinal purposes. *Hibiscus rosa-sinensis* is a medicinal plant member belonging to the family Malvaceae. *Hibiscus Rosa sinensis* has been used in Siddha medicine, a traditional Tamil system from South India, for many centuries. Hibiscus extracts have been used for ages in Ayurveda to cure many ailments.

Objectives: The present work is undertaken to determine Nutraceutical Potential and Antimicrobial Potential of Hibiscus Flowers.

Results: The present work has shown presence of Vitamin B1, Vitamin B2, Vitamin B6 and Anthocyanin in the powder of dried Hibiscus Flowers. Furthermore, it showed Antioxidant potential which could be attributed to presence of Phytochemicals such as Saponin, Flavonoid, Anthraquinone, Steroid etc. Besides, two extracts namely, Aqueous and Acidified prepared from the powder of dried Hibiscus Flowers were tested for their Antimicrobial potential against *E. coli*, *K. pneumoniae*, *P. aeruginosa*, *S. typhi*, *E. faecalis*, Methicillin Resistant *Staphylococcus aureus* (MRSA) and *C. albicans* using MIC, MBC/MFC and Agar Well Diffusion Methods. However, in the present *in vitro* study, none of the extracts were effective against any of the 7 organisms tested.

2. Determination of Antimicrobial and Anti-Biofilm activities of Alum and its “*Bhasma*”: an “*In vitro*” comparative study.

Team:

- Miss Susan Martin (STRIP Student)
- Mrs. Dipti Kolte (Bacteriology Department),
- Dr. Anuya Rege (Mentor, Bacteriology Department)

Funding Agency: Haffkine Institute (STRIP Fee)

Duration: January 2022 – June 2022 (STRIP Batch- II)

Abstract: STRIP project work is in process.

Abstract

Microbial infection is an acute condition which needs quick treatment in the form of different Antimicrobial agents. There is urgent need to search for alternative option to minimise the side effects and resistance cases of antibiotics. Furthermore, Biofilms are problematic in medical, industrial and environmental settings. In the present study, Alum will be procured from Local Store/Market, whereas, it's commercially available Bhasma would be procured from local Ayurvedic store. Alum as well as it's *Bhasma* will be evaluated for their Antimicrobial potential against four gram positive as well as four gram negative Bacteria and two Fungi. Very little information is available on Anti-biofilm activities of Alum and it's *bhasma*. Hence, they will be also assessed for their effect on Microbial Biofilms.

3. Isolation and Identification of Hydrocarbon Biodegrading Bacteria from Soil Samples.

Team:

- Miss Sakshi Ajay Gupta (STRIP Student)
- Mrs. Jayashree More (Mentor, Bacteriology Department)

Funding Agency: Haffkine Institute (STRIP Fee)

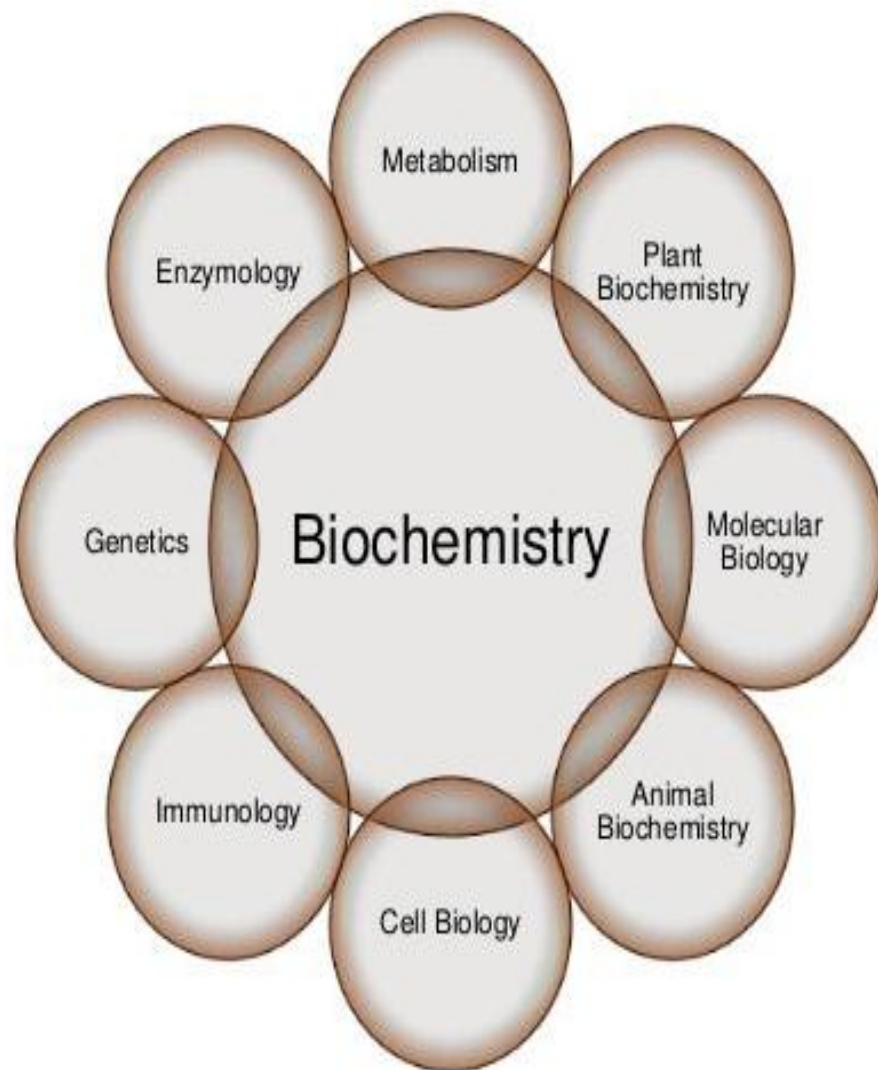
Duration: January 2022 – June 2022 (STRIP Batch- II)

Abstract: STRIP project work is in process.

Abstract

One of the major environmental problems today is hydrocarbon contamination resulting from the activities related to the petrochemical industry. Accidental release of petroleum products are of particular concern in the environment. Bioremediation is the promising technology for the treatment of these contaminated sites since it is cost effective and will lead to complete mineralization. Bioremediation functions basically on biodegradation. Understanding the process of biodegradation requires an understanding of the microorganisms and their pathways that make the process work. Several microorganisms, including fungi, bacteria and yeasts are involved in the biodegradation process.

This study focuses on finding indigenous bacterial species from soil samples capable of Hydrocarbon degradation and evaluating their biodegradability. The steps included enrichment and isolation of hydrocarbon degrading bacteria, morphological and biochemical characterization, qualitative and quantitative assay for hydrocarbon degradation and 16S rRNA sequencing of microorganisms showing highest degradation of hydrocarbons.



Biochemistry

Biochemistry

2020-21 and 2021-22



Dr. Usha Padmanabhan

Head of the Department

(HOD from 18/02/2020 - 31/03/2021)

Incharge from 11/01/2017 - 15/10/2019)

Overview

The Department of Biochemistry was established in 1923. The department is actively involved in basic and applied research, testing activities including pre-clinical cytotoxicity assays, snake venom and ASV testing, and training programs. Unique and novel testing services offered by the Department are chemical testing of honey and biochemical analysis of gall bladder and kidney stones. At present, various independent and collaborative projects focused on diseases prevalent in India are being pursued.

Understanding pathogenesis of the diseases at molecular level would aid in better management of the diseases at different levels, i.e., diagnosis, therapy and prognosis. Screening of traditional medicinal formulations and synthetic compounds for therapeutic activities using 'in vitro' and 'in vivo' techniques forms an integral part of the departmental research activities. Pharmacological studies on traditional medicines will enable their wider acceptance and will also result in finding novel applications.

Dr. Usha Padmanabhan

Covid -19 Highlights (2020-21)

The departmental staff contributed to the Covid-19 testing activities in the Institute as below:

SR.NO.	EMPLOYEE / STUDENT NAME	PERIOD
1	Dr. Usha Padmanabhan (H.O.D.)	April - May 2020
2	Dr. Amruta Naik (S.O)	April- Oct 2020
3	Mrs. Sanika Parkar (S.T.A)	April 2020 to August 2021
4	Mr. Sameer Patil (S.T.A)	April- Jul 2020
5	Mr. Pravin Shirsat (Laboratory .Assistant)	April 2020 to Jul 2020
6	Miss. Prachi Salanke (P.hd. student)	Aug 2020
7	Miss Amritpal Kaur (P.hd. student)	July - Aug 2020
8	Miss Bhagyshree Thorat (P.hd. student)	Aug 2020
9	Miss. Snehal (M.Sc student)	July - Aug 2020

The department has conducted a clinical trial to see the effect of BCG on Covid -19 Patients

The department would like to focus more on clinical research with public health implications.

Covid -19 Highlights (2021-22)

The departmental staff contributed to the Covid-19 testing activities in the Institute as below

SR.NO.	EMPLOYEE NAME	PERIOD
1	Dr. Amruta Naik (S.O)	May 2021
2	Mrs. Sanika Parkar (S.T.A)	August 2021



Department Photograph

Research Projects 2020-21

1. Phase II Clinical Trial to investigate BCG as a therapy for Covid-19

Team:

- Dr. Usha Padmanabhan, HOD, Department of Biochemistry – PI
- In collaboration with BJ and Sassoon Hospital, Pune

Funding agency - Icortis International

Budget - Rs. 15 Lakhs,

Duration - 3 months

Abstract

Bacillus Calmette–Guérin (BCG) is widely used in national vaccination programs worldwide. It is accepted that BCG alleviates both pathogen and allergy induced respiratory diseases that could also include Covid-19. To investigate this possibility, we randomly assigned 60 Covid-19 patients, after admission to the hospital with pneumonia and requirement for oxygen therapy in a 1:1 ratio to receive either a single adult dose of intradermal BCG or normal saline with concomitant standard of care (SoC) medications. Primary endpoints were favorable prognosis of Covid-19 as deduced from resolution of pneumonia, viremia and secondary outcome were enumeration of ICU admissions, duration thereof and mortalities.

Results

Both primary and secondary endpoints were significantly improved in the BCG+SoC group. This could be seen from reduction in oxygen requirement due to Covid-19 associated pneumonia decreasing from day 3-4, improved radiological resolution from day 7-15. There were a total of 6 (10%) adverse events in the study of which 2 deaths and 4 ICU admissions were in SoC group (1 ICU admission culminated in death of the subject) and in contrast only 1 ICU admission in the BCG+SoC group. While there was an increase in Covid-19 specific IgG levels in the BCG+SoC group, there was no evidence of BCG induced cytokine storm in this group. Four patients showed localized inflammatory response at the injection site in the BCG+SoC group.

Conclusions

BCG+SoC administration resulted in a significantly higher percentage of patients with favorable outcomes than did SoC. A third of the patients were naïve for childhood BCG vaccination. This mimicked elderly patients in countries with no universal vaccination policy for BCG. No BCG related adversity was seen in this group. The study shows that BCG is a safe, cost-effective treatment that can be introduced as a standard of care in patients with moderate Covid-19 that can reduce requirement of oxygen supplemented beds and disease burden in low resource countries, with additional long-term benefits of reducing risk for tuberculosis.

Ethical approval was obtained from the Institutional Ethics Committee (IEC) of the BJ Medical College & Sassoon Hospital, Pune. The trial was also approved by the Drug Controller General of India (DCGI) and was registered with Clinical Trial Registry of India no. CTRI/2020/05/025013. (CTRI is a Primary Register of the International Clinical Trials Registry Platform (ICTRP, <http://www.who.int/ictcp/search/en/>).

2. Isolation, characterization and expression of monoclonal antibodies from re-convalescent plasma.

Team:

- Dr. Usha Padmanabhan^{1*}, Dr. Mohammed Faizal^{2*}, Dr. Sajal Mitra³, Dr. Rajesh Deshmukh⁴, Dr. Sanjay Mukherjee⁵
 - 1 In-Charge, Biochemistry Haffkine Institute for Training, Research & Testing, Mumbai.
 - 2 Head, Orthopaedics, Govt. Medical College Hospital, Nagpur.
 - 3 Dean, Govt. Medical College Hospital, Nagpur.
 - 4 Director, Haffkine Institute for Training, Research & Testing, Mumbai
 - 5 Prin. Secretary, Medical Education & Drugs Dept., Govt. of Maharashtra
- *Both are Co-PIs on the project.

Funding agency - Smith & Nephew Healthcare Pvt. Ltd.,

Budget - Rs. 1 Lakhs

Duration - 2 years

Abstract

The Covid-19 pandemic since its outbreak in December 2019 has infected more than 10 million people worldwide, with numbers still increasing. Among the many lines of therapy, re-convalescent plasma seems to be the more successful than others in mitigating the symptoms of the disease. Re-convalescent plasma therapy utilizes the antibodies produced by the human immune system in individuals who have been exposed to the virus which after transfusion will confer resistance to the virus to those who have been exposed to it.

Mechanism of antibody production

The mechanism of antibody production by the immune system is through a series of interactions between macrophages, T cells and B cells. Infectious agent antigens are engulfed and partially degraded by antigen-presenting cells (APCs). Fragments of the antigen will appear on the surface of the APC attached to a cell surface glycoprotein known as MHC II. The antigen-MHC II complex allows Th cells to bind to the APC which leads to a proliferation of Th cells and release of cytokines. T cells then bind to the MHC complex on B cells leading to proliferation and differentiation of B cells. B cells change into plasma cells which secrete large quantities of finely tuned antibodies specific to the foreign agent. Some B cells are changed into memory cells, which can generate a faster antibody-mediated immune response upon future infection.

In the case of nCoV-SARS-2, the Spike (S) protein and some domains of S are speculated to be the major antigens.

Regardless of the antigen, reconvalescent plasma is expected to contain multiple antibodies to nCoV-SARS 2. Variation in reconvalescent plasma (and hence efficacy) arises both because of the antigenic properties of antibodies and the predominance of any one antibody towards a particular antigen that may vary between individuals. The project proposes to isolate, Clone and express monoclonal antibodies to reduce this variation so that treatment with mAbs will provide uniform efficacy and protection in all individuals.

The project has been approved by Ethics committee of GMC, Nagpur, however since the study was started, the use of reconvalescent plasma was restricted by ICMR and hence the study did not go forward. With permission from Smith & Nephew the funds were re-directed to another project.

Research:

- Estimation of wound healing activity of medicinal plant.

Future plan for 1-3 years:**Testing:**

1. On the recruitment of MD Pathology in the institute, testing of blood biochemistry, stone analysis will be restarted.
2. Effect of medicinal formulations will be tested on animals for their effect on blood pressure.

Training:**Research:**

1. Estimation of Antidiabetic Potential of Ayurvedic Metallic Formulation.

Facility:

Animal tissue culture facility, Department of Biochemistry

Research Projects 2021-22

1. Assessment of bioavailable iron from herbometalic preparations.

Team

- Dr. Amruta Naik
- Collaborator - Dr. Aditi Kulkarni, Podar medical college, Mumbai.

Funding agency: Intramural

Abstract

Anaemia is one of the major abnormality found in India, irrespective of age and gender. In Ayurveda, it has been mentioned that the herbometalic preparations are helpful in the treatment of the anaemic conditions. The bioavailability of the iron from these ayurvedic drugs is yet not estimated and hence in this study the actual uptake of the iron from these formulations will be studied using a cell line model.

Introduction:

Therapeutic dosage of herbometalic Ayurvedic drugs is very small and still these substances when used are really effective. Each herbometalic preparation is a composite of herbal ligands and molecule of iron. Hence the spectrum of action is enhanced in the conditions like anaemia. This aspect of therapeutics calls for the need to investigate the actual uptake of iron content of these formulations by cells.

Hence it is need of an hour to take up the study to estimate the bioavailability of different herbometalic formulations.

Actual iron uptake by cells from the herbometalic formulations has not yet been studied. Thus, this study has focus on the investigation of iron bioavailability from eight different herbometalic Ayurvedic drugs.

Objectives:

- To estimate the iron uptake by the cell line model from study drugs.

2. Estimation of Anti-diabetic Potential of Ayurvedic Metallic Formulation.

Team

- Dr. Amruta Naik
- Collaborator: Dr. Aditi Kulkarni, Podar medical college, Mumbai.

Funding agency: Once the MOU signed it will be submitted to AYUSH.

Abstract

Type 2 diabetes (T2D), which is much more common, is primarily a problem of progressively impaired glucose regulation due to a combination of dysfunctional pancreatic beta cells and insulin resistance. Diabetic nephropathy is reported to be responsible for 25% of mortality in diabetes mellitus as it is a major sequel of diabetes mellitus, leading to end stage renal disease. Identification and assessment of therapeutic potential of natural compounds have been led to the discovery of innovative and economical drugs to treat several diseases, including diabetes.

Suvarna Raj Vangeshwar is an Ayurvedic metallic formulation prepared using Kupipakwa rasayana method. In clinical practice, it is used by Ayurvedic practitioners in conditions Prameh or Meha which is correlated with diabetes mellitus.

In vitro cell based assay is an appropriate and inexpensive method for understanding of anti-diabetic action of compound. Various medicinal plants has been explored so far with respect to their anti-hyperglycemic activity but very less work has been done so far on the herbometalic preparations with respect to anti diabetic potential. Hence, in this proposed study the anti-hyperglycemic effect of the Suvarna Raj Vangeshwar will be monitored to understand it's mode of action.

Introduction:

Diabetic nephropathy (DN) or diabetic kidney disease refers to the deterioration of kidney function seen in chronic type 1 and type 2 diabetes mellitus patients. The progression of the disease is known to occur in a series of stages and is linked to glycemic and blood pressure control. Till now a medicine which can reverse glomerular damage and has a reno-protective effect in DM cases is not available.

In such conditions one has to depend on a stringent glycemic and blood pressure control. Meha resembles Micro-albuminuria, which is a characteristic feature of diabetic nephropathy. Meha is a one of the therapeutic target of Suvarna Raj Vangeshwar (SRV). Hence, it may prove to be the one to induce the anti-hyperglycemic effect. Therefore, there is a possibility that it might be effective in DM conditions with respect to its anti-hyperglycemic effect. Thus, the current study is aimed at investigating the anti-diabetic ability of a SRV by using in vitro assays where the anti-hyperglycemic capabilities of this formulation will be monitored.

Objectives:

- To estimate the anti-hyperglycemic activity of SRV *in vitro*.

3. Effect of Snake Venom on Human Cells.

Team

- Dr. Amruta Naik
- Collaborator: Dr. Usha Padmanabhan

Funding agency: DHR (NVRC funding)

Abstract

Snake venoms have evolved a wide diversity of peptides and proteins that induce harmful inflammatory and neurotoxic effects including severe pain and paralysis, hemotoxic effects, such as hemorrhage and coagulopathy, and cytotoxic/ myotoxic effects, such as inflammation and necrosis. Although sufficient in most cases, snakebite treatments have been challenged by the continuous high numbers of clinical illness and mortality associated with snakebites worldwide. Chronic morbidity following snakebites have been underestimated, with many victims reporting chronic symptoms in the bitten region, including complex regional pain syndrome and musculoskeletal disabilities. Available snakebite treatments face challenges associated with high incidences of adverse reactions along with poor efficacy against local tissue effects.

Therefore, there is a need of more research work directed to the development of more effective snakebite therapies which will enable to overcome severe acute and chronic effects caused by snakebites. Understanding the cellular mechanisms of how the venom act especially at the bite site will help to identify ways to prevent severe complications of the snake bites e.g. tissue destruction. Therefore, this study focus on the determination of events that underlie cellular exposure will help to identify pathways perturbed by crude venom explain some of the pathological effects observed in local envenomation. Data obtained from this study may serve as the basis for diverse translational research for the utilization of snake venom in the therapeutics.

Introduction

Envenomings result in death or severe morbidity in humans and, despite advances in management, snakebite remains a major public health problem, particularly in developing countries. Consequently, the World Health Organization recently recognized snakebite as a neglected tropical disease that affects ~2.7 million p.a.

The biological effects induced by snakebite are currently treated with intravenous administration of anti-venom in combination to analgesics, fluid therapy, hemodialysis and/or antibiotics. Cellular pathways triggered by the venom and its toxins are still poorly understood. It is a need of time now to provide a better understanding of action mechanisms and effects and to highlight their undetermined targets and potential novel therapeutic targets that might have implications for improving the treatments of snakebites. Snake venoms are complex natural secretions comprised of hundreds of different molecules with a wide range of biological functions & actions. Hence in order to explore these for their utilization in biomedical sciences it is also important to explore their effects at cellular level. Thus, this study is focused on the effect of Indian big four snake venom i.e. Cobra, Russell's viper, krait and saw-scaled viper venom on human cells of various tissues / organs origin.

Objectives:

- To estimate the induction of cell death by snake venom in human cells.
- To monitor the effect of snake venom on cell death markers in human cells.

4. To isolate various Subunits of various kinds Venom of (Indian big four) and understand antigenicity against ASVs

Team

- Dr. Usha Padmanabhan
- Dr. Amruta Naik and RA (to be recruited)

Funding agency: DHR (NVRC funding)

Abstract

Cobra, Russell's viper, krait and saw-scaled viper are the Indian big 4 venoms. The most common sea snake along the Indian coast, is the **hook-nosed sea snake** (*Hydrophis schistosa*). Then come two other species, the annulated sea snake (*H. cyanocinctus*) and Malacca sea snake (*H. caeruleus*). There is no antidote available specifically for sea snake venom.

Snake venoms are complex mixtures of enzymes and proteins of various sizes, amines, lipids, nucleosides, and carbohydrates. Venoms also contain various metal ions that are presumed to act as cofactors and include sodium, calcium, potassium, magnesium, and zinc. Polypeptide toxins (molecular weight 5-10 KDa) include cytotoxins, cardiotoxins, and postsynaptic neurotoxins (such as α -bungarotoxin and α -Cobratoxin), which bind to acetylcholine receptors at neuromuscular junctions. Viperid venom contains 80-90% elapid venoms 25-70% enzymes (3-150 KDa) of, which damage vascular endothelium.

There are 4 manufacturers of antivenom in India. High quality snake antivenoms are the most effective treatment to prevent or reverse most of the venomous effects of snake bites. Another issue is that the amount of antivenom used for treatment also needs to be standardized since in most cases, there is a overuse of antivenom leading to unwanted sideeffects in patients.

This project aims to isolate subunits / peptides/ emzymes present in snake venom and identify which the leading antigen in snake venom and if possible standardize the dose of antivenom for neutralization of each venom type.

The project has been approved by the expert committee overseeing the NVRC project. The project will be soon submitted to Biosafety committee for approval.

5. To evaluate occurrence of snake bites and effectiveness of mitigation measures in the State of Maharashtra

Team

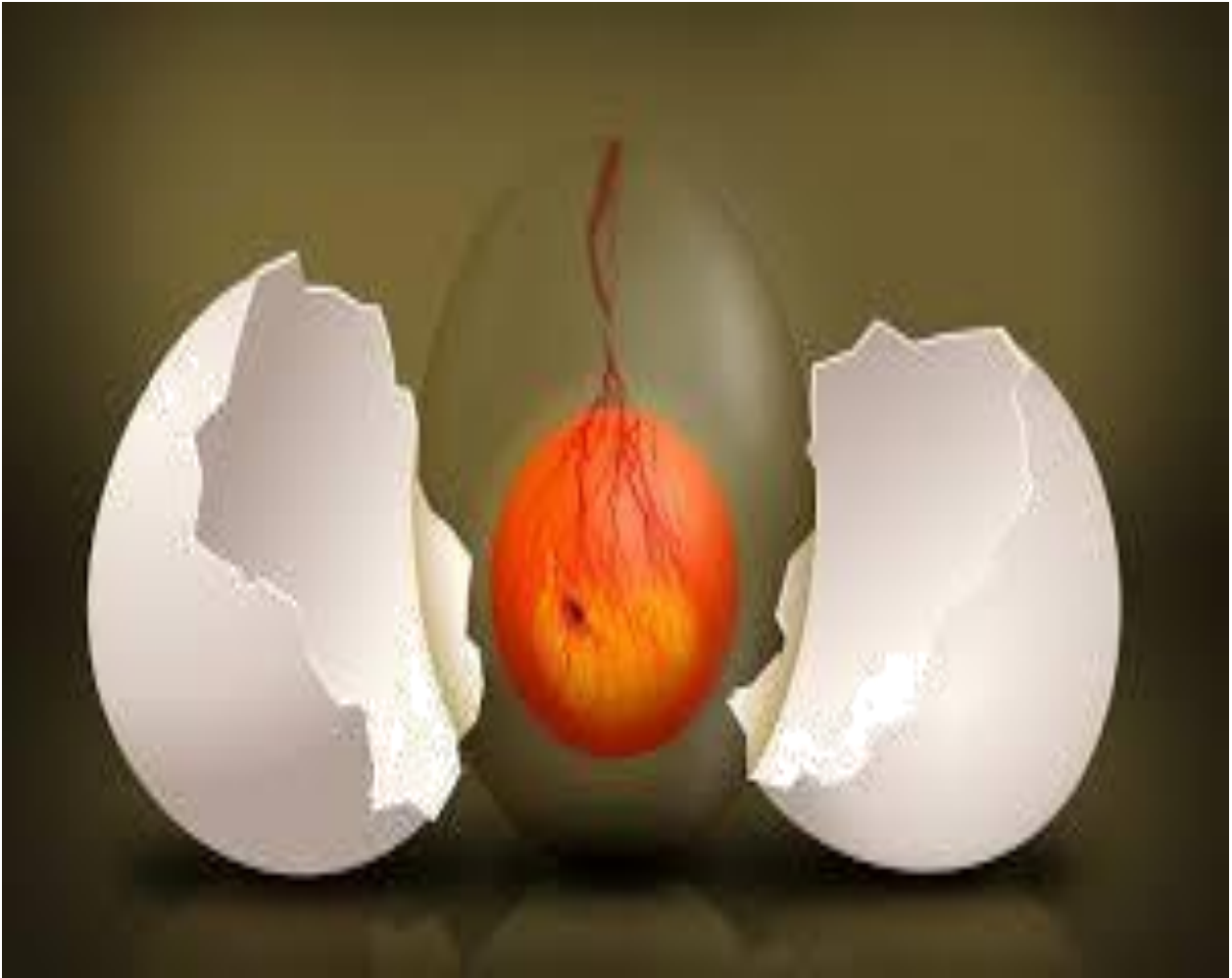
- Dr. Usha Padmanabhan
- Statistician

Abstract

Under-reporting of snake bite incidence and mortality is common. In Nepal, for example, where 90% of the population lives in rural areas, the Ministry of Health reported 480 snake bites resulting in 22 deaths for the year 2000, yet figures for the same year collected in a community based study of one region (Eastern Nepal) detailed 4078 bites and 396 deaths.

Likewise, a very large community-level study of snakebite deaths in India gave a direct estimate of 45 ,900 (99% CI: 40,900-50,900) deaths in 2005, which is over 30 times higher than the Government of India's official figure. Revised estimates based on verbal autopsies and other data now suggest that as many as 1.2 million Indians died from snakebite envenoming between 2000-2019 (average of 58,000/year). A comparison of hospital-registered deaths in one district of Sri Lanka to data from the Registrar-General's office on deaths demonstrated that 62.5% of deaths from snakebite envenoming were not reported in hospital data.

Most deaths and serious consequences of snake bites are entirely preventable by making safe and effective antivenoms more widely available and accessible. The project aims to collect data from all PHC, SHC and THC in the State of Maharashtra with help from Public Health and MEDD to understand whether snake bites are being underreported and if so by how much.



Cell Biology

Cell Biology

2020-21 and 2021-22



Dr. Shashikant Vaidya
Head of the Department
15/10/2019-17/12/2020



Dr. Usha Padmanabhan
Head of the Department
From 18/12/2020-31/03/2022
From 11/01/2017–15/10/2019

Overview

This department focuses on different aspects of cell biology and is in keeping modern approaches that are used in medicine. In accordance with the Institute's mandate of Training, Research & Testing the department makes its charter.

Testing: Over the past year, the department has initiated genome sequencing as a testing program for Novel Corona virus variant identification through Nanopore sequencing and hopes to expand the scope of this technology into prognostics and personalised medicine through identification of SNPs etc.

The department wishes to get into small animal transgenic studies for commercial pre-clinical testing and research.

Research: The department will study (1) Basic cellular pathogenesis of infectious diseases such as modes of entry of pathogens into cells, amplification of pathogens at the systemic level and novel etiological agents (2) Cellular signalling mechanisms in non-infectious diseases such as oncogenic transformation of normal cells through acquisition of self-renewal properties and/or mutations and their progression to cancer (3) Developmental of organisms by studying spatio temporal effects of differentiation of stem cells in development of specific tissues and modulation of disease progression by pathogen induced alterations in stem cell differentiation programs which in turn causes changes in immunity.

Training: The department has initiated a new Training program called Advance research techniques (ART) which offers short internships for a period of 2-4 months and students are given hands-on training in techniques of protein and nucleic acid analyses, cell culture and in vivo egg development. The department has participated in the Institutional training programs and has successfully trained 4 students (2020-21) and 10 students (2021-22) in the short term internship program, of whom 02 students have been placed and 02 have moved to get further education.

Over the past year, the department is affiliated to the University of Mumbai for M.Sc. in Applied Biology and Maharashtra University of Health Sciences in Applied Medical Biology for Ph.D. degree. Given the opportunity, the department wishes to train more students throughout the year in research methodology through short projects, as well as enroll students for M.Sc. and Ph.D. studies.

Dr. Usha Padmanabhan



Department Photograph

Research Projects 2020-21

1. Investigating the role of Inositol pyrophosphates in the development of Prostate

Cancer.

Team	Dr. Usha Padmanabhan , Dr. Rosalind Marita* Director, Bayview Research Services, Charni Road, Mumbai and former, HOD Biochemistry department, Haffkine Institute
Funding	Department of Biotechnology, New Delhi coordinated by Rajiv Gandhi Center for Biotechnology, Thiruvananthapuram, 2015 – 2018.

Abstract

Introduction

Prostate cancer is the fifth leading cancer occurring in men above the age of 45. In India it is the 10th cause of mortality among older men. Growth and differentiation of the prostate gland during development is dependent on the androgens testosterone and dihydro-testosterone, which are released by the testis, which is turned under the control of the hypothalamus and the pituitary and forms a part of the HPG axis. Many of the pathways which control growth and differentiation are also prognostic factors in the development of prostate cancer (PCa).

Novel approaches for both diagnosis and treatment of PCas include the identification of new proteins involved in either the process of cellular transformation or contribute to signaling mechanisms which aid tumorigenesis and have identified the Hedgehog (Hh) signaling pathway which is expressed in stem cells and has been shown to aid both development of the prostate in embryos and malignant transformation of prostate cells. Inositol pyrophosphate (in particular, InsP7) is primarily synthesized by Ip6 kinase (Ip6-K) action on InsP6 and are degraded by the diphosphoinositol phosphate phosphatases (DIPPS) encoded by *NUDT* genes. That InsP7 has a role in prostate cancer is indicated by the fact that (1) The Ip6-kinase knockout mice are sterile, suggesting poor androgen production (2) Sonic hedgehog (Shh) signaling in *D. rerio* is downregulated by the use of TNP, a specific inhibitor of Ip6-K inhibitor and (3) The *NUDT* genes, encoding the DIPPs have been associated with genetic risk loci involved in prostate cancer. The main objectives of the project are (a) Role of InsP7/Ip6-Ks/DIPP in PCa growth, (b) Effect of modulation of InsP7/ Ip6-Ks /DIPPS on growth of PCa in response to testosterone/DHT, (c) Role of inositol pyrophosphates in prostate development and (d) Role of inositol pyrophosphates in Hh signaling. Our results show that inhibition of Ip6 kinases and reduction of inositol pyrophosphates causes a reduction in expression of the Hh pathway as shown below. The mechanism by which this happens is under investigation.

2. Isolation, Characterization and Screening of potential anti-inflammatory drugs from Coral (*Corallium rubrum*)

Team

- Dr. Usha Padmanabhan,
- Dr. Narendra Bhatt*,
- Dr. Vandana Kozarekar*,
- Ms. Priyanka Mohite. *Cria Care Pvt. Ltd, Parel, Mumbai

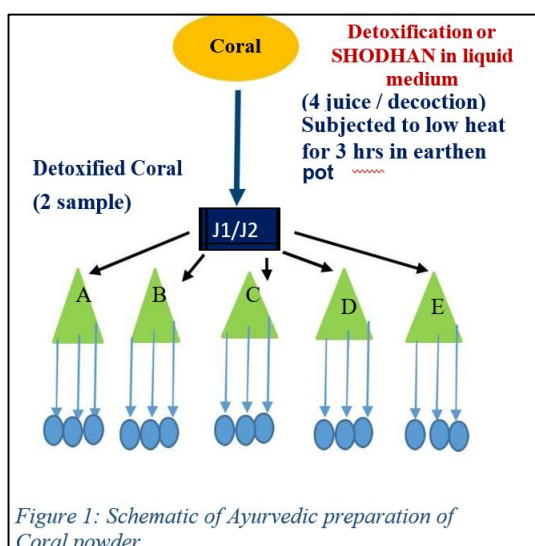
Funding - Ministry of Earth Sciences, New Delhi co-ordinated by Central Drug Research Institute, Lucknow.

Budget - Rs. 18.00 Lakhs received. Rs. 48 lakhs sanctioned

Abstract

Introduction

The marine ecosystem offers a huge potential for the discovery of drugs. Our ancient knowledge of Ayurveda has harnessed the active ingredients of several marine products for treatment of several chronic conditions. Modern biology has isolated anti-inflammatory molecules from a variety of coral (Praval) sub-species. However, a modern scientific approach is needed in order to translate traditional medicine into active clinical therapeutics. The program asks us to submit extracts from Coral to CDRI for evaluation of anti-inflammatory activity. The main objectives of the project are (a) To Procure Praval (Coral or *Corallium rubrum* and its varieties) from authorized dealer.



(b) To make formulations of Praval as per the standard guidelines proposed within Ayurvedic texts. (c) The chemical analysis of raw coral, the intermediates during the ayurvedic formulation process and the final ayurvedic formulation by using modern analytical techniques and (d) To contribute to the scientific understanding of traditional medicinal knowledge. Dr. Bhatt and Dr. Kozarekar successfully sourced authentic coral. At Haffkine, Dr. Padmanabhan and Ms. Mohite first extracted raw coral with 95% alcohol and subsequently with 50% alcohol. Raw coral powder was soxhlet extracted using solvents with sequentially increasing dielectric constant.

These extracts have been sent to CDRI, Lucknow for further evaluation. A new method for solubilization of hard coral skeletons has been standardized and a publication regarding the same has been submitted. The Ayurvedic processing was outsourced under direct guidance, design and monitoring of Dr. Bhatt and Dr. Vandana as shown in the scheme below (Fig 1). The procured raw coral (Praval) was subjected to shodhan, and maran, process involving trituration and heat treatments to obtain Praval bhasma, as per classical description in Ayurveda. The intermediate after shodhan process requires 5 maran process thereby giving 5 variants of praval bhasma. There are 4 types of Shodhan each of which will be made into 5 variants of Bhasma: Toluene, Xylene Chloroform, DCM, Ethyl acetate, and extracts of the same have been prepared. All extracts thus far have been characterized using UV spectroscopy, TLC, GC and HPLC at Haffkine and are in the process of being sent to CDRI. TLC analyses of Chloroform extracts is shown in Fig 2.

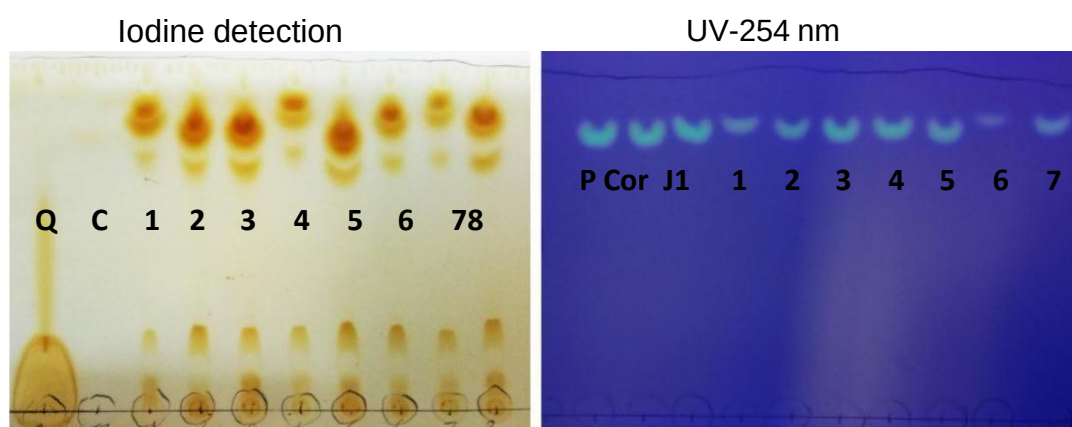


Figure 2 : TLC analysis of Chloroform extracts of sample 1-8 shown in Fig. 1

3. Preparation of recombinant BCG vaccine

Team	- Dr. Usha Padmanabhan, HOD, Department of Biochemistry -- PI
Funding	- Smith & Nephew
Budget	- Rs. 3.4 Lakhs

Abstract

The novel coronavirus nCoV-19 or 2019-nCoV (novel severe acute respiratory coronavirus 2 or nSARS-CoV-2), has affected more than 10 million people worldwide, resulting in significant mortality and is responsible for the global pandemic COVID-19. The clinical course of COVID-19 is variable with older age and the presence of comorbidities increasing the risk of more severe disease. It is notable that nCoV-19 has the fastest rate of mutation compared to any other infective virus and newer mutant strains of the virus causing varying forms of disease constantly emerging from South Africa, Brazil, UK characterized at the genomic level.

A number of vaccines have been launched by a variety of manufacturers across the world such as (1) Covishield (2) Covaxin (3) Johnson & Johnson (4) Sputnik V etc. Expectedly these are largely for pre-exposure prevention of Covid-19 (i.e. prophylaxis) and work through inducing nCoV-19 specific immunity. There are reports of vaccine shortage in India while positivity rate of exposure to nCoV-19 (second wave) largely ascribed to the newer mutants of the virus is increasing.

In this scenario another 3 vaccines Pfizer, Moderna, and Novavax may be given clearance for use in India. Most manufacturers and the Govt. are only claiming that their respective vaccines are suitable for preventing severe disease leading to mortalities. However despite mass vaccinations, vaccine efficiencies have been falling, and the duration of immunity provided by the vaccines is unclear because nCoV-19 induced Covid is still only 12 months old.

It is largely accepted that the world in general has lost a generation of people to the virus and that social distancing norms would remain until nCoV-19 is eradicated similar to polio virus or small pox virus. Thus we need a vaccine that targets the virus while at the same time delivers long term and variant independent immunity.

This study proposes to deliver nCoV-19 components through creation of recombinant BCG, to induce an immune response (1) which is specific to nCoV-19 and (2) provides the long term and variant independent immunity.

4. Role of Inositol pyrophosphate in chick embryo development

Team

- Dr. Usha Padmanabhan
- Mr. Suresh Yadav (STRIP Student)
- Ms. Panali Panchal (STRIP Student)
- Ms. Arpita Sathyanarayanan (STRIP Student)
- Ms. Shraddha Kameshwar (STRIP Student)

Abstract

Introduction

Model organisms are non-human species that are studied to understand specific biological phenomena, disease, molecular pathways, and behaviors. Despite different adult forms, these organisms share similar developmental mechanisms and structures (figure 1).

These organisms usually have metabolic/ molecular aspect similar humans and are easy to handle in laboratories. Model

organisms can be plants, microbes (e.g., yeast) or animals (e.g., flies, fish, worms, and rodents), each of which have a genetic makeup and all of which have been relatively widely studied. The chick embryo is an extremely amenable system to study the mechanisms that set the initial embryonic polarity and result in the formation of the embryonic axis, or primitive streak and lead to formation of the entire organism. The main

objective of the study is to understand vertebrate growth. Following embryonic growth we observed slower growth in embryos when treated with TNP, as shown in Fig 2.

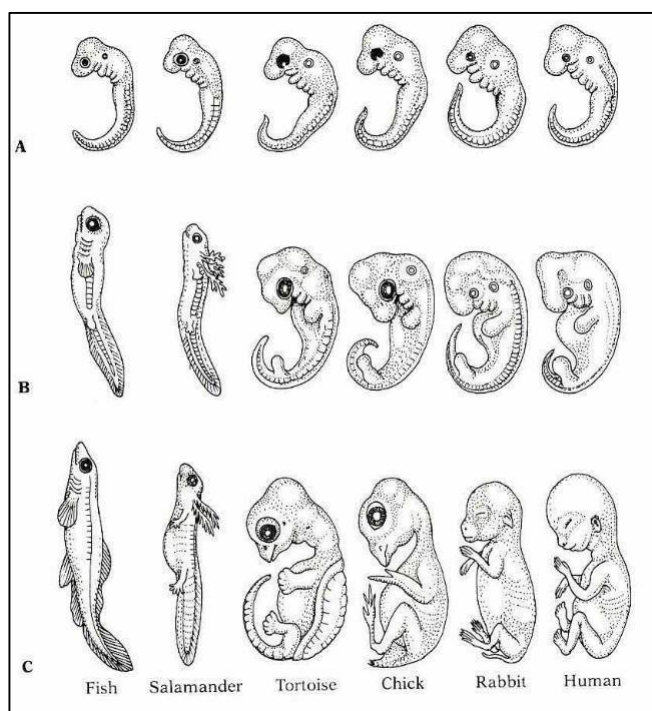


Figure 1: Early embryonic development of various species showing conserved structures.

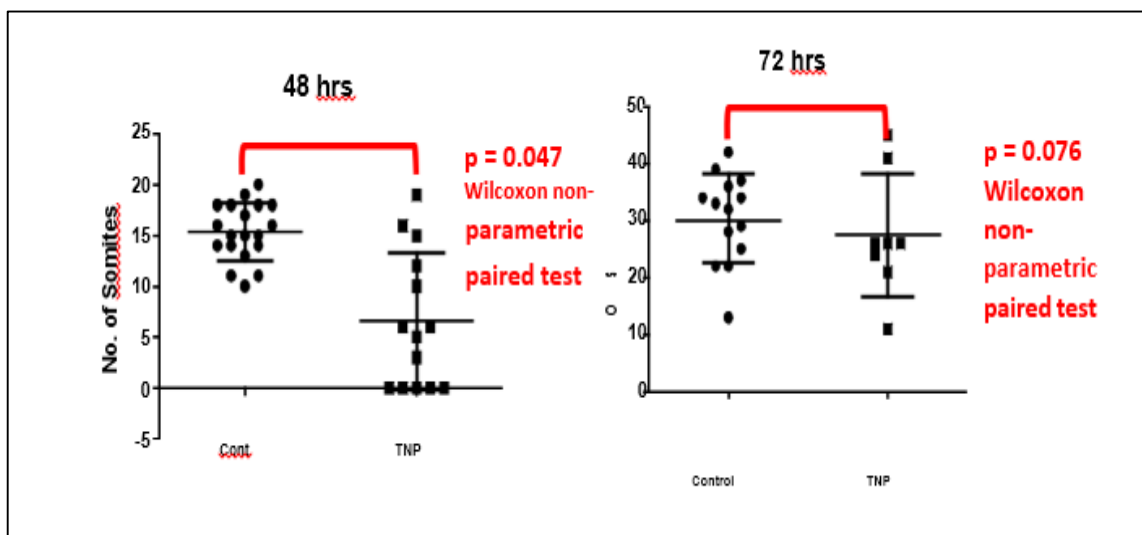


Fig 2: Decrease in no. of somites upon treatment with TNP.

All physiological markers, such as limb development, head fold, heart beat and development, were observed at appropriate stages. Localization of Shh was studied and was observed in the notochord and the somites. Ip6K localization was also seen in the somites.

(Please note that all projects of Extramural Funding were funded when Dr. Usha Padmanabhan was HOD of the Department)

1. Determination of variation in IGHV and IGLV gene in a healthy population

Team

- Dr. Usha Padmanabhan (PI) &
- Ms. Gauri Rake

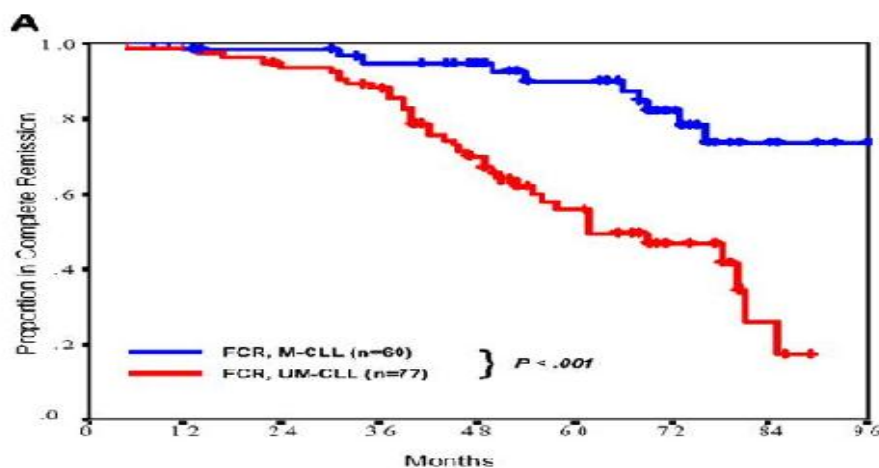
Abstract

Introduction

B cell chronic lymphocytic leukemia (CLL) is a cancer of the blood and bone marrow that is characterized by the accumulation of leukemic lymphocytes that co-express CD5, CD19, and CD23. The clinical course of CLL is extremely variable. Given the toxicities associated with currently available therapies, being able to predict which patients will need treatment plays a significant role in reducing morbidity and mortality [1, 2].

The four prognostic markers that currently are in common use in clinical practice are the following: (1) immunoglobulin heavy-chain variable region (IgVH) mutational status, (2) interphase fluorescence in-situ hybridization (iFISH) abnormalities (del(17p13), del(11q23), del(13q14), and trisomy 12), (3) CD38, and (4) zeta-associated protein (ZAP)-70 [3]

The immunoglobulin heavy chain variable region gene (IgHV) mutation status has been an established prognostic factor in patients with CLL. A cutoff of 2% deviation or 98% sequence identity to germline in the IgHV sequence has been routinely used as a prognostic marker. Several studies demonstrated that patients with mutated IgVH respond better to chemoimmunotherapy, whereas patients with unmutated IgHV have a shorter time to treatment, shorter time to next treatment, inferior response to chemotherapy/chemoimmunotherapy, higher chemotherapy resistance rate, and lower survival rate. [4,5,6]



Duration of complete remission. In the FCR cohort, patients with CLL cells that used mutated *IgVH* (M-CLL) had significantly longer complete remission duration than did patients with CLL cells that used unmutated *IgVH* (UM-CLL) [6]

Proposed Methodology: This project aims to establish the baseline variation in IGHV and IGLV gene in a healthy Indian population. For this we will use haematocrit from blood samples drawn from institute employees for AMC. We are assuming that employees of the institute are healthy individuals.

In CLL patients, as 80-90% of all leukocytes in blood will be abnormal B cells, DNA is directly extracted from peripheral blood samples.

For healthy individuals, CD19 positive B cells will be isolated from the haematocrit samples. As per Agathangelidis et al, DNA extraction will be done from these isolated cells samples, PCR will target VDJ region for amplification and sequencing of IGHV/IGLV genes [7].

Expected outcome and future studies: To our knowledge, variations in IGHV and IGLV in an Indian population have not been studied. Our study will help establish the baseline variation in IGHV and IGLV gene in a healthy Indian population. We hope to compare this data with CLL patient data so that we can establish the method of diagnosis for CLL cancer patients at the Institute.

Project has been approved by the external expert, Dr. Pravin Shingare (ex Dean, Directorate of Medical Education & Research & presently Vice Chancellor, Krishna Institute of Medical Sciences, Karad). It is proposed that the project be carried out in collaboration with Krishna Institute of Medical Sciences, Karad.

Project is awaiting approval from Institutional Ethics committee & Institutional Biosafety committee, Haffkine Institute.

2. Isolation of Monoclonal Antibodies from Rabies infected Horse Serum.

Team

- Dr. Usha Padmanabhan (PI) &
- Ms. Snehal Annadate (STRIP Student)
- Mr. Shantanu Dighe (STRIP Student)

Abstract:

Rabies is a contagious and fatal zoonotic disease caused in humans by the Rabies virus (RABV), a member of the Lyssavirus genus (a virus form that causes encephalitis) belonging to the Rhabdoviridae family. It is one of the Neglected Tropical Diseases (NTD) that leads to lethal neurological damage and is estimated to cause approximately 59,000 deaths worldwide annually due to factors such as the existence of huge global rabies reservoirs and limited access to treatment.

The deaths can be controlled by following proper and timely Post Exposure Prophylaxis (PEP) consisting of wound cleaning, anti-rabies immunoglobulin (RIG) administration, and vaccination. However, due to poor supply across the world, high cost, and varying batch-to-batch quality of sera-derived immunoglobulins, many of the patients progress toward the clinical phase having a 100% fatality rate. The World Health Organization (WHO) advises treatment with both anti-rabies immunoglobulins and anti-rabies vaccine for Grade-III post exposure prophylaxis.

The literature so far summarizes the key features of the different available monoclonal antibodies against rabies, focusing on their application in post exposure prophylaxis and highlighting their potential in a novel therapeutic approach. The study mentioned that the development of an anti-rabies immunotherapy based on a cocktail of two broadly neutralizing monoclonal antibodies, RVC20 and RVC58 has been described in a preclinical study using mice. The use of these antibodies was successful at treating rabid mice even at later stage of the infection. This is the first in vivo proof of concept for a treatment of symptomatic rabies with monoclonal antibodies, which could be the premise of a new paradigm shift in the treatment of rabies in humans.

Other studies suggested that NP-19-9 and 11B6 are potent candidates to be used for PEP, suggesting further studies involving clinical studies in human. Currently, several anti-rabies virus monoclonal antibody (mAb) products are under development as alternatives to RIG, and two recently received regulatory approval in India.

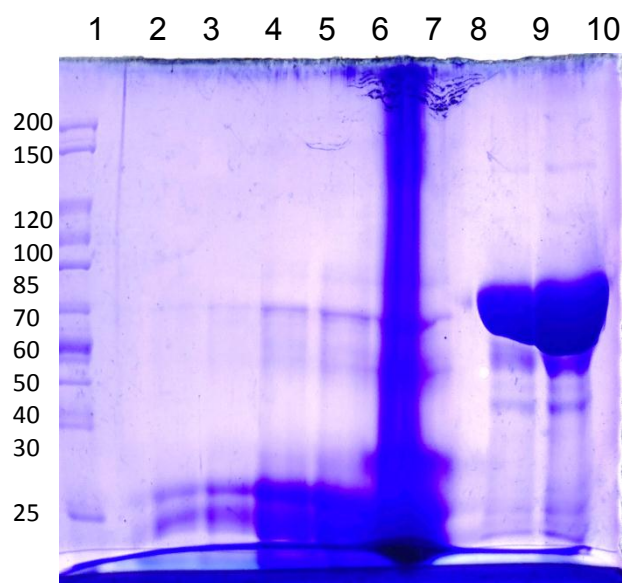
The shift from anti-rabies immunoglobulins to monoclonal antibodies is not yet a reality on global scale. Rabies is a disease present particularly in countries with low economic resources, and the phases of clinical trials for these categories of deadly diseases are complicated and require an important number of patients with a category III rabies exposure. However, mAbs are still considered as a promising alternative to the current treatments. With the advances in mAb engineering, the generation of different forms of antibody fragments can be made possible, which may open new avenues to the development of safe, efficient and cheaper mAbs to be used to fight rabies.

The extraction, purification, and development of anti-rabies monoclonal antibodies from horse serum can prove to be a promising alternative to rabies immunoglobulin. With a uniform efficacy, better accessibility, and high affordability, it can act as a highly standardized treatment against rabies.

Hypothesis:

Extraction and cloning of monoclonal antibodies against the rabies virus can act as a promising cost-effective alternative to the sera-derived anti-rabies immunoglobulins with uniform protection in all individuals. The project aims to extract, purify and clone monoclonal antibodies with high specificity towards rabies virus from rabies infected horse serum.

Preliminary data:



Lane 1 : PageRuler™ Unstained Protein Ladder 5 μ l., Catalog number: 26614, Thermo Scientific™,
 Lane 2 : Nil
 Anti rabies horse serum vaccine (HBPCL)
 Lane 3 : 5 μ g, (1:100 diluted)
 Lane 4: 10 μ g, (1:100 diluted)
 Lane 5: 25 μ g, (1:10 diluted)
 Lane 6: 50 μ g (1:10 diluted)
 Lane 7: Undiluted vaccine
 Lane 8: Nil
 Inactivated Virus Vaccine (Abhayrab)
 Lane 9: 10 μ g, (1:10 diluted)
 Lane 10: Undiluted vaccine

Project has been approved by external expert. It is awaiting approval from Biosafety committee, Haffkine Institute

3. Isolation, Characterization and Screening of potential anti-inflammatory drugs from Coral (*Corallium rubrum*) (Extramural Funding)

Team

- Dr. Usha Padmanabhan,
- Dr. Narendra Bhatt*,
- Dr. Vandana Kozarekar*,
- Ms. Priyanka Mohite. *Cria Care Pvt. Ltd, Parel, Mumbai

Funding - Ministry of Earth Sciences, New Delhi co-ordinated by Central Drug Research Institute, Lucknow.

Budget - Rs. 18.00 Lakhs received. Rs. 48 lakhs sanctioned.

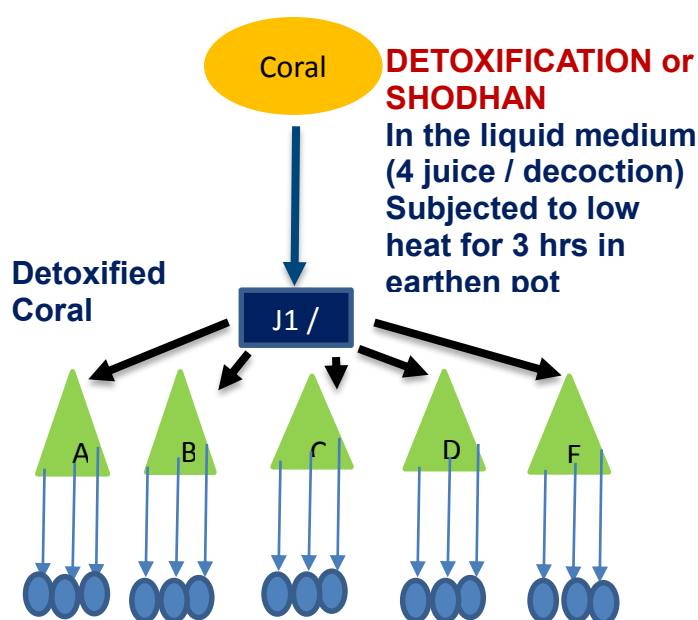


Figure 1: Schematic of Ayurvedic preparation of Coral powder

Abstract

Introduction

The marine ecosystem offers a huge potential for the discovery of drugs. Our ancient knowledge of Ayurveda has harnessed the active ingredients of several marine products for treatment of several chronic conditions. Modern biology has isolated anti-inflammatory molecules from a variety of coral (Praval) sub-species. However, a modern scientific approach is needed in order to translate traditional medicine into active clinical

therapeutics. The program asks us to submit extracts from Coral to CDRI for evaluation of anti-inflammatory activity. The main objectives of the project are (a) To Procure Praval (Coral or *Corallium rubrum* and its varieties) from authorised dealer. (b) To make formulations of Praval as per the standard guidelines proposed within Ayurvedic texts. (c) The chemical analysis of raw coral, the intermediates during the ayurvedic formulation process and the final ayurvedic formulation by using modern analytical techniques and (d) To contribute to the scientific understanding of traditional medicinal knowledge.

Dr. Bhatt and Dr. Kozarekar successfully sourced authentic coral. At Haffkine, Dr. Padmanabhan and Ms. Mohite first extracted raw coral with 95% alcohol and subsequently with 50% alcohol. Raw coral powder was soxhlet extracted using solvents with sequentially increasing dielectric constant. These extracts have been sent to CDRI, Lucknow for further evaluation. A new method for solubilization of hard coral skeletons has been standardized and a publication regarding the same has been submitted.

The Ayurvedic processing was outsourced under direct guidance, design and monitoring of Dr. Bhatt and Dr. Vandana as shown in the scheme below (Fig 1). The procured raw coral (*Praval*) was subjected to *shodhan*, and *maran*, process involving trituration and heat treatments to obtain *Praval bhasma*, as per classical description in Ayurveda. The intermediate after *shodhan* process requires 5 *maran* process thereby giving 5 variants of *praval bhasma*. There are 4 types of *shodhan* processes, each of which will be made into 5 variants of *bhasma*. Toluene, Xylene Chloroform, DCM, Ethyl acetate, and extracts of the same have been prepared. All extracts thus far have been characterized using UV spectroscopy, TLC, GC and HPLC at Haffkine and are in the process of being sent to CDRI. TLC analyses of Chloroform extracts is shown in Fig 2.

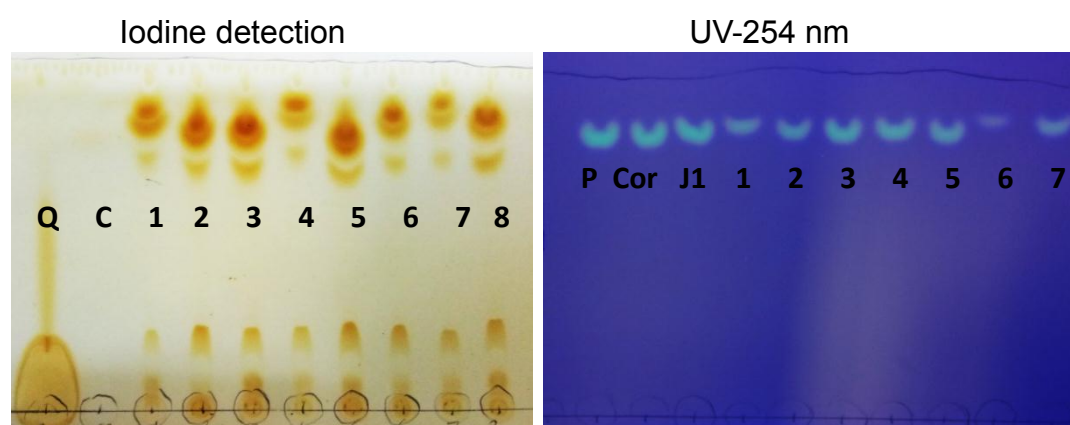


Figure 2: TLC analysis of Chloroform extracts of Sample 1-8 shown in Fig. 1

4. Role of Inositol pyrophosphate in chick embryo development

Team

- Dr. Usha Padmanabhan
- Mr. Suresh Yadav (STRIP Student)
- Ms. Panali Panchal (STRIP Student)
- Ms. Arpita Sathyanarayanan (STRIP Student)
- Ms. Shraddha Kameshwar (STRIP Student)
- Vinti Saw (STRIP Student)
- Shruti Mahajan (STRIP Student)

Abstract

Introduction

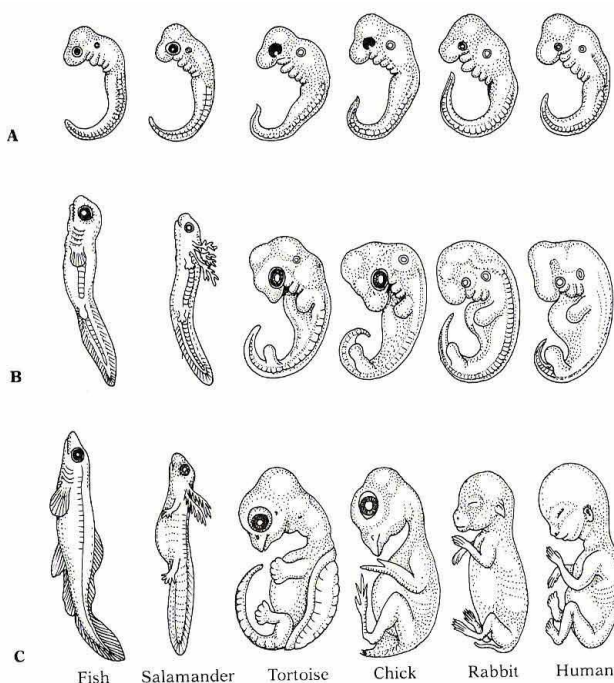
Model organisms are non-human species that are studied to understand specific biological phenomena, disease, molecular pathways, and behaviors. Despite different adult forms, these organisms share similar developmental mechanisms and structures (figure 1).

These organisms usually have metabolic/ molecular aspect similar humans and are easy to handle in laboratories. Model organisms can be plants, microbes (e.g, yeast) or animals (e.g, flies, fish, worms, and rodents), each of which have a genetic makeup and all of which have been relatively widely studied.

The chick embryo is an extremely amenable system to study the mechanisms that set the initial embryonic polarity and result in the formation of the embryonic axis, or primitive streak and lead to formation of the entire organism.

The main objective of the study is to understand Ip6Kinase signaling during vertebrate growth.

Following embryonic growth we observed slower growth in embryos when treated with TNP, as shown in Fig 2.



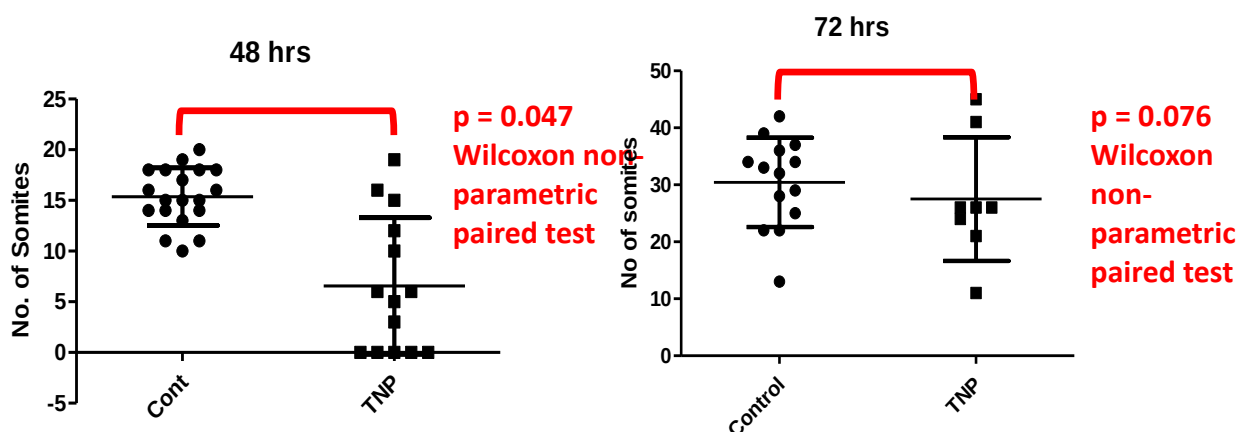


Fig 2: Decrease in no. of somites upon treatment with TNP.

All physiological markers, such as limb development, head fold, heart beat and development, were observed at appropriate stages. Localization of Shh was studied and was observed in the notochord and the somites. Ip6K localization was also seen in the somites.

This observation is rather remarkable since somites are literally the building blocks of the vertebrate body plan. They are blocks of mesoderm that are located on either side of the neural tube in the developing vertebrate embryo. Somites also determine the migratory paths of neural crest cells and of the axons of spinal nerves. They are precursor populations of cells that give rise to important structures associated with the vertebrate body plan. When the somite is still immature, it is multipotent, and will eventually differentiate into dermis, skeletal muscle, cartilage, tendons, and vertebrae. The commitment to specific tissue types occurs relatively late in the development of the somite.

The first pair of somites forms in the anterior part of the trunk, adjacent to the notochord; the remainder then follow, budding off the mesoderm sequentially, from head to tail. Distinct regions of each somite become specific tissue and cell types as the body matures.

Following this observation, in continuation of our studies with the chick embryo, it is seen that somite development is a endocrine system controlled event.



Chemical Testing Unit



Chemical Testing

Chemical Testing

2020-21 and 2021-22



Mrs. Suvarna Pachpore
Head of the Department

Overview

Department of Chemical Testing is one of the older Department's in Haffkine Institute.

Chemical Testing Department is majorly involved in Testing of Alcoholic Beverages received from Maharashtra State Excise Department. This includes Country Liquor from Manufacturer, Country Liquor from Retailer, Indian Made Foreign Liquor (Vodka, Rum, Whiskey, Beer, etc), Toddy.

Apart from Alcoholic Beverages, Department is also involved in Testing of Denaturants for Liquor. As we know that besides consumption alcohol has wide applications in different fields like disinfectant, cosmetic, fuel, cleaning agent etc. In this case when alcohol is used for these purposes it is denatured with few chemicals to make it unfit for consumption. These denaturants are also tested in Chemical Testing Department.

Various Training programs are conducted in department like TAB, STRIP (6 months). In the year 2020-21 whole staff of Chemical Testing Department has contributed for Testing of Covid-19 samples during pandemic situation along with their regular job responsibilities in department and in the year 2021-22 during COVID 19 pandemic department has served in testing of sanitizers.

Various Training programs are conducted in department like Workshop on Testing of Alcoholic beverages (TAB), STRIP (6 months).

The training programs are as follows:

1. Workshop on Testing of Alcoholic Beverages (TAB) – This is a two day training program conducted in various batches every year during March to June. Rating received for this course is usually Very Good to Excellent.
2. Short Term Research Internship Program (STRIP) – This program provides research platform to students for a period of 6 months. Department provides training to STRIP students in the field of Nanoparticles and Phytochemistry.

Chemical Testing Department is a Maharashtra FDA approved Department.

Mrs. Suvarna Pachpore



Department Photograph

Research Projects 2021-22

1. To determine Nutraceutical Potential and Antimicrobial Potential of Powder of Dried Hibiscus Flowers.

Team

- Mr. Atsih Dongarkar (Student, Chemical Testing Department)
- Mrs. Suvarna Pachpore (Mentor, Chemical Testing Department)
- Dr. Anuya Rege (Co-Mentor, Bacteriology Department).
- Mrs. Dipti Kolte (Bacteriology Department)

Funding Agency - Haffkine Institute

Duration - December 2021 – March 2022

Budget - 20 Thousand

Abstract-

Introduction:

Nutraceuticals, in broad, are food or part of food playing a significant role in modifying and maintaining normal physiological function that maintains healthy human beings. These nutraceuticals help in combating some of the major health problems of the century such as obesity, cardiovascular diseases, cancer, osteoporosis, arthritis, diabetes, cholesterol etc. In whole, 'nutraceutical' has led to the new era of medicine and health, in which the food industry has become a research oriented sector. India is a rich source of Medicinal plants and called "Botanical Garden of World" with enormous wealth of Biodiversity. There are almost 45,000 plant species recorded in India so far of which 7,500 species have been used for medicinal purposes. Hibiscus rosa-sinensis is a medicinal plant member belonging to the family Malvaceae. Hibiscus Rosa sinensis has been used in Siddha medicine, a traditional Tamil system from South India, for many centuries. Hibiscus extracts have been used for ages in Ayurveda to cure many ailments.

Objectives:

The present work is undertaken to determine Nutraceutical Potential and Antimicrobial Potential of Hibiscus Flowers.

Results:

The present work has shown presence of Vitamin B1, Vitamin B2, Vitamin B6 and Anthocyanin in the powder of dried Hibiscus Flowers. Furthermore, it showed Antioxidant potential which could be attributed to presence of Phytochemicals such as Saponin, Flavonoid, Anthraquinone, Steroid etc. Besides, two extracts namely, Aqueous and Acidified prepared from the powder of dried Hibiscus Flowers were tested for their Antimicrobial potential against *E. coli*, *K. pneumoniae*, *P. aeruginosa*, *S. typhi*, *E. faecalis*, Methicillin Resistant *Staphylococcus aureus* (MRSA) and *C. albicans* using MIC, MBC/MFC and Agar Well Diffusion Methods. However, in the present in vitro study, none of the extracts were effective against any of the 7 organisms tested.



Chemotherapy

Chemotherapy

2020-21 and 2021-22



Ms. Suvarna Pachpore
Head of the Department
(03/03/2020 to 18/12/2020)



Dr. Ashish L Asrondkar
Head of the Department
(18/12/2020 to 31/03/2022)

Overview

The Chemotherapy Department is one of the oldest department in the Haffkine Institute. The department has been engaged in research to address issues of immediate public health concern since its inception. The Department of Chemotherapy is engaged in Training, Research & Testing activities.

Chemotherapy Department mainly focused on the synthesis of heterocyclic compounds for their putative medicinal benefits. Compounds have been synthesized and characterized through Analytical Instrumentation facility available in the department. The department of Chemotherapy uses green techniques to synthesize heterocyclic compounds (i.e. microwave irradiation). Department also focused on research using *in silico* drug designing tool. The Institute currently has a project approved by DHR, and the department forms part of the project.

The department has taken part in institutional training programmes and trained students in the short-term internship programme. For M Sc and Ph D degrees, the department is affiliated to the University of Mumbai for the subject of Chemistry.

The department has two registered guides for M. Sc. and Ph. D. degree from University of Mumbai.

1. Dr. Ashish Asrondkar-Registered Guide for M. Sc. and Ph. D. (Chemistry)
2. Dr. Vrushali Patil- Registered Guide for M. Sc. and Ph. D. (Chemistry)

Details of students of M. Sc. degree in Chemotherapy Department: (2020-21)

Sr. No.	Name of the student	Degree	Guide Name	Current status
1	Priti Bendre	M.Sc.	Dr. Ashish Asrondkar	Thesis submitted
2	Aniket Maskar	M.Sc.	Dr. Vrushali Patil	Topic approval submitted

Details of students of Ph.D. degree in Chemotherapy Department: (2021-22)

Sr. No.	Name of the student	Degree	Guide Name	Current status
1	Ms Harshada Sawant	Ph.D.	Dr. Vrushali Patil	Topic approval submitted
2	Ms Amarin Sheikh	Ph.D.	Dr. Ashish Asrondkar	Topic under preparation

For Science graduate and postgraduate students, the department offers various short-term training program for a one month, 45 days, 3 months and 6 months (STRIP) for Science graduate and postgraduate students.

The department wants to increase the number of students trained in research technique through short projects throughout the year, as well as enroll students for M.Sc. and Ph. D. Programs.

Department has three FDA approved chemist for Chemical and Instrumentation section. The department provides testing facility on HPLC (High Performance Liquid chromatography), GCMS (Gas chromatography Mass Spectrophotometer), and IR (Infrared Spectrophotometer) samples on commercial & academic purposes. Recently department initiated two advanced training courses on HPLC and GCMS instruments.

1. Hands on Training on HPLC (Duration-01 month)
2. Advance training on GC-MS (Duration -01 month)

The department submitted a proposal for the establishment of a NABL accredited laboratory at Haffkine Institute for Training, Research, and Testing. Medical Education and Drugs Department of Maharashtra government has praised and approved the project. District planning development committee (DPDC) Mumbai division funded instruments worth Rs 2.4 crore for the establishment of NABL lab at Chemotherapy department.

Dr. Ashish L Asrondkar

The departmental staff contributed to the Covid-19 testing activities in the Institute listed below:

2020-21

Sr. No	Name of Staff
1.	Dr. Ashish L Asrondkar
2.	Dr. Vrushali N Patil
3.	Mr. Sushant R Kaple
4.	Mr. Pramod Andhere
5.	Mr. Rohan A Patil
6.	Mr. Maruti V Chile



Department Photograph

Departmental Projects 2020-21

1. Synthesis and Biological evaluation of Benzothiazole Derivatives.

Team

- Dr. Ashish Asrondkar (Guide),
- Mrs. Priti Bendre (M Sc Student)

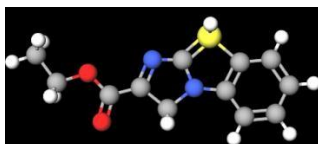
Funding agency - Haffkine Institute

Project Duration - 2015- 2020 (Thesis submitted)

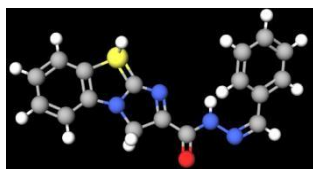
Abstract:

Benzothiazole can serve as unique and versatile scaffolds, especially in synthetic and pharmaceutical chemistry because of their potent and significant pharmacological activity. Benzothiazole are fused constituted rings, which contain the heterocycles bearing sulphur and nitrogen atoms constitute the core structure of thiazole and many pharmacologically and biologically active compounds. This important class of derivatives posses numerous pharmacological activities like antitumor, antimicrobial, anti- inflammatory, antioxidant, antidiabetic activities and so on. This unique molecule must act like a boon in the field of developing various synthetic biologically active compounds. In this project our aim to synthesized following benzothiazole derivatives.

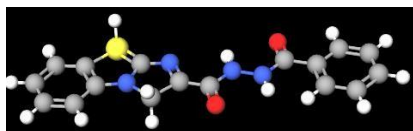
SERIES 1:-Synthesis of ethyl substituted-3,9a-dihydroimidazo[2, 1-b][1,3] benzothiazole-2-carboxylate



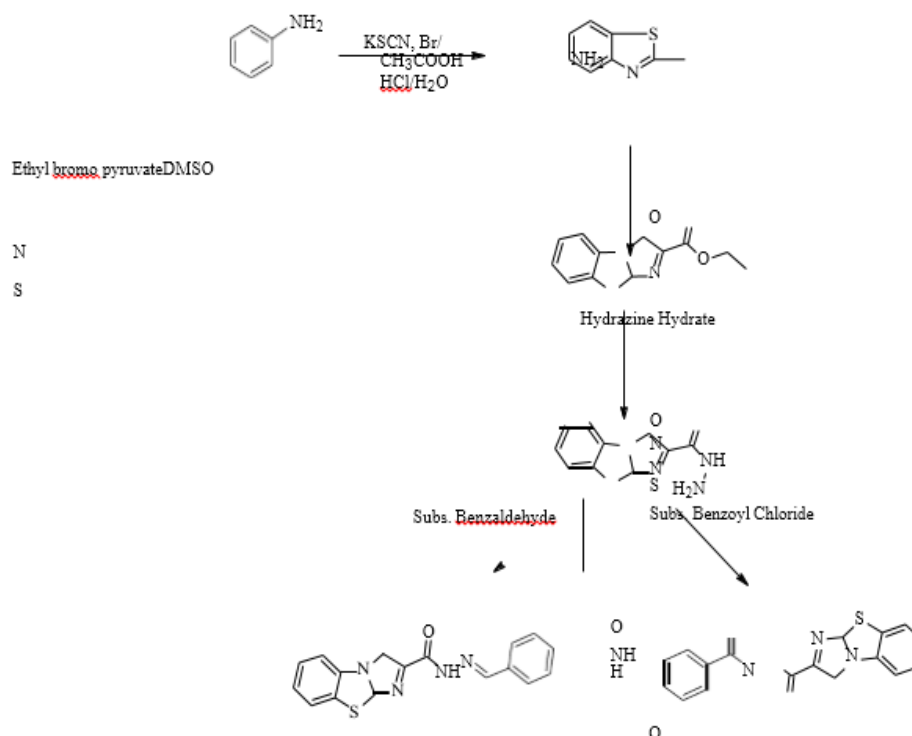
SERIES 2:- Synthesis of *N'*-[(1*E*)-substituted]-3, 9a-dihydroimidazo[2,1- *b*] [1,3] benzothiazole-2-carbohydrazide



SERIES 3:- Synthesis of *N'*-(Substituted benzoyl)-3,9a-dihydroimidazo[2,1-b][1,3]benzothiazole-2-carbohydrazide



Schematic Representation



Objectives

1. Synthesized the proposed compounds.
2. Confirmed the structures of the synthesized compounds by Spectroscopic and chromatographic technique.
3. In vitro Screening of synthesized compounds for their Ant-Inflammatory, Anti-Oxidant and Anti-cancer activity.

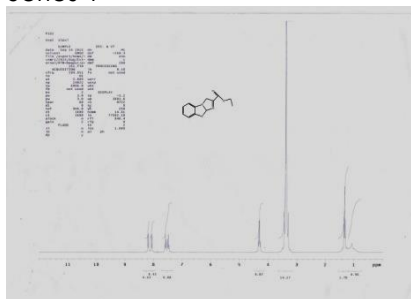
Results and Conclusions

In this study, 3 scheme for project were completed and to be evaluated for biological activities.

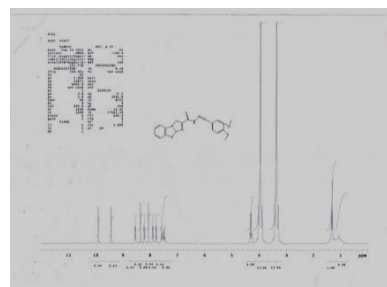
Results of few synthesized compound are (NMR, Mass and FTIR) represented below

NMR spectra

Series 1

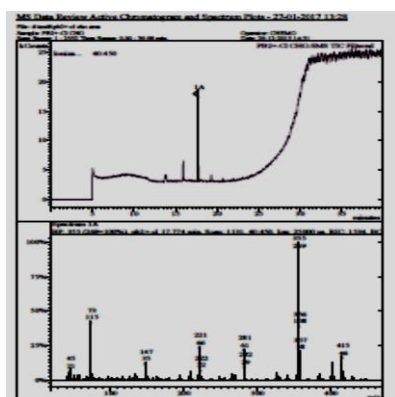


Series 2

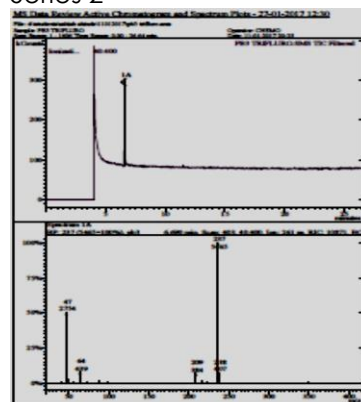


Mass spectra

Series 1

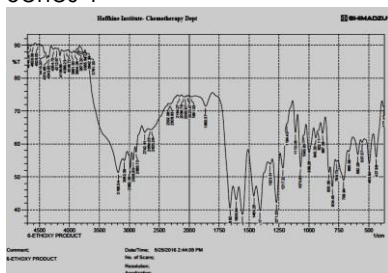


Series 2

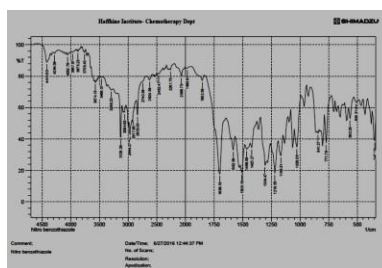


FTIR spectra

Series 1



Series 2



2. Synthesis and Characterization of Bioactive Indole and Chromone derivatives

Team

- Dr. Vrushali Patil (Guide),
- Aniket Maskar (M Sc Student)

Funding agency - Haffkine Institute

Project Duration - 2020 – 2023

Abstract:

According to the survey of world health organization (WHO), in India with a population of 1.35 billion there are around 1.16 million cancer cases out of which 784800 patients have been died because of cancer. In which brain tumour is a major increasing cause of a death. There are different types of brain tumour in which Glioblastoma is one of the major deadly tumors it is considered to be one of the aggressive cancer in humans. Current chemotherapeutic drugs for glioblastoma treatment are ineffective because of their low tolerance and poor blood-brain barrier (BBB) permeability. Angiogenesis has been the major topic of scientific interest in the field of malignant tumors. Recently, targeting angiogenesis has achieved the progress in various tumor treatments by several mechanisms, including the use of anti-angiogenic small molecule receptor tyrosine kinase inhibitors (TKIs). Tyrosine kinases are important target because they play a vital role in the modulation of growth factor signaling. TKIs compete with the ATP binding site of the catalytic domain of several tyrosine kinases. The development of TKIs, which they inhibits the pro-angiogenic receptors, mainly vascular endothelial growth factor receptor (VEGFR) family, have significantly prove to suppress the growth of various tumors with limited nonspecific toxicities. Therefore the heterocyclic moiety serves as perfect framework on which pharmacophores can be effectively attached to produce novel drugs. Among various heterocyclic compounds, nitrogen and oxygen based heterocycles have been extensively investigated as they constitute the core structures of numerous biologically relevant molecules. Accordingly Indole (Nitrogen containing molecule) and Chromone (Oxygen containing molecule) analogues will be synthesized by conventional method and microwave assisted method to inhibit the growth factor receptors i.e. vascular endothelial growth factor receptors. (VEGF). Further menthol is conjugated to BSA (MeB) to overcome the permeability of BBB. Synthesized Indole and Chromone analogues loaded MeB nanoparticles are developed for glioma targeting therapy. Thus by inhibiting angiogenesis in tumor cells we can suppress the growth of tumor. However growth factor receptors plays a major role in angiogenesis. Hereby we assume that by inhibiting growth factor receptors, angiogenesis can be restricted by using small molecules i.e. tyrosine kinase inhibitors.

3. Synthesis and Characterization of Menthol modified Albumin Nanoparticles

Team

- Dr. Vrushali Patil (Guide)
- Afshan Rizvi (Strip Student)

Funding agency - Haffkine Institute

Project Duration - January –June 2021

Abstract:

Glioma, a life-threatening cancer type, accounts for 3% of cancer cases reported worldwide, showing an 80% malignancy rate. Conventional treatment has been rendered inept due to the existence of the blood-brain barrier (BBB). The endothelial membrane possessing minimal diffusion and permeability capacity hinders the passage of prominent chemotherapeutic drugs to the brain. Aromatic resuscitation drugs, also known as brain penetration enhancers, help guide the drugs to target the glioma site by penetrating the BBB. Albumin nanoparticles have emerged as a favorable candidate due to their numerous advantages. Camptothecin, a notable anti-cancer alkaloid drug, was chosen as a suitable drug of choice for menthol-modified BSA nanoparticles to effectively target the tumor cells in the glioma site. Menthol-modified BSA was successfully prepared, with positive results demonstrated from HPLC and UV spectrophotometry. Further studies which include nanoparticle preparation, together with in-vitro studies, various assays for determining its mode of action and efficiency, as well as safety evaluation tests are to be conducted.

4. Molecular docking approach of Glycyrrhizin analogues for identification of potential inhibitor for SARS-CoV-2. (Project in Progress)

Team

- Dr. Vrushali Patil (PI)
- Dr. Ashish Asrondkar (Co-PI)
- Dr. Shashikant Vaidya (Co-PI)

Funding agency - SERB

Scheme - CRG Short-term special call on COVID-19

Reference No - 462020000844

Abstract

SARS-CoV-2 (2019-nCoV), a novel coronavirus, has caused and is continuing to spread the outbreak of pneumonia in India and worldwide. As the world awaits eagerly for therapy for SARS-CoV-2 (2019-nCoV). There have been several attempts and efforts have been initiated to examine potential of several natural compounds derived from plant source. At present there is no specific treatment is available thus identifying novel and effective treatments would be most benefit to patients. Researches on SARS-CoV have identified that a variety of agents have the potential to treat SARS-CoV infection. Of which, glycyrrhizin is one of the most promising candidates as it was found to be active against SARS-CoV. The 2019-nCoV host receptor angiotensin-converting enzyme 2 (ACE2), is the same as the SARS-CoV host receptor. ACE2 targeting holds the promise of preventing and inhibiting infection in 2019-nCoV. Indian herbs in medicine may be a valuable source for finding active compounds to treat 2019-nCoV infection. In this project, we summarize several active compounds, glycyrrhizine analogs, which could potentially have anti-2019-nCoV influence. Currently, three clinical trials are started on glycyrrhizin against COVID 19 (Trial ID-ChiCTR2000029768 ChiCTR2000030490 from China and IRCT20200404046933N1 from Iran) Based on the above fact, we focused on the lycyrrhizin molecule as a major component for our study as well as structurally similar glycyrrhizin compounds and their analogs are used for research. Hansen Chen showed that docking results glycyrrhizin has the potential binding to ACE2 with an estimated ΔG (kcal/mol) - 9, with the binding, cites ARG-559, GLN-388, ARG-393, ASP-30. Further studies are needed to verify results and further screening of glycyrrhizin related compounds is also the most important task. An attempt is made for identification of potential ligands from analogues of glycyrrhizin targeted against SARS CoV-2 using molecular docking studies by using Schrodinger. Glycyrrhizine can emerge as a promising agent for the treatment of COVID-19, appreciated for its various pharmacological effects. More importantly, some glycyrrhizin derivatives with a significantly higher anti-virus activity compared to glycyrrhizin itself may also be a good option. Therefore in this project based on the binding score we select molecule and screen theirs In vitro Anti- SARS CoV 2 activity and cytotoxicity.

Departmental Projects 2021-22

1. Design, development, and biological assessment of Rabies using heterocyclic derivatives.

Team

- Dr. Vrushali Patil (Guide)
- Miss. Harshada Sawant (Ph.D. Student)

Funding agency - Haffkine Institute

Duration - 2021- 2026

Abstract:

Rabies is a zoonotic disease that affects both humans and animals. It is caused by the RABV virus of the Lyssavirus genus, transmitted through the bite of infected mammals. Rabies is usually transmitted from the saliva of infected dogs. Currently, vaccination is only preventive treatment available against RABV virus. As it doesn't have any specific treatment till now, due to which the survival rate of the patient was very low. After clinical disease is developed, the death is fatal. In the light of the above anti-rabies agents are clearly needed. Ectodomain homo-trimeric spikes is responsible for fusion of the virus with host cells, it leads to increase in the activity of the virus. The proposed study, is aimed to develop heterocyclic derivatives and plant based derivatives to inhibit interaction between the rabies and drug moiety.

2. Synthesis of Heterocyclic derivative using Ronglite as a catalyst.

Team

- Dr. Ashish Asrondkar (Guide)
- Miss Amarin sheikh (Ph.D. Student)

Funding agency - Haffkine Institute

Duration - 2021- 2026

Abstract

Heterocyclic sulfones have a long history of use and are a common component of effective pharmaceuticals and physiologically active compounds. A sulfone is a chemical compound with two carbon atoms and a sulfonyl as a functional group. The core hexavalent sulphur atom is double-bonded to two oxygen atoms and single-bonded to two carbon atoms. For diversity-oriented synthesis, sulfones are employed as the starting material. For a variety of biologically active compounds, the sulfone moiety is a key structural motif. Synthetic chemists are continually interested in different techniques to manufacture sulfones due to their biological value and proven difficulty in synthesis. In this context, rongalite is available as a commonly available source of sulfonate dianion and a facile approach for preparing sulfones.

Rongalite is a salt and is represented by a chemical formula $\text{Na}^+\text{HOCH}_2\text{SO}_2 \cdot 2\text{H}_2\text{O}$. It has many names such as rongalite, formaldehyde sodium sulfoxylate, Bruggolite. The salt is water soluble and commercially available in dihydrate form. It is used as a bleaching agent and its derivatives are used in dye industry. Rongalite has been identified to mediate a wide range of organic transformations, and it has a wide range of applications in organic synthesis.

Because of its biological actions, the goal of my endeavour is to insert the sulfone group into the indole moiety and to study its various transformation with the aid of rongalite.

In first series synthesis of sulfone from sultine with the use of rongalite has been explored. The derivatives applicable in Diels Alder reaction. In a second series selectively 4-Bromo indole on reaction with rongalite in presence of metal afford sulfones. In a third series, Indole and substituted indole react with rongalite in presence of oxidant and catalyst and different condition will be studied. In Fourth series, alkylation of 1-H indole in presence of rongalite and potassium carbonate will be trying to carry out.

3. In Silico Studies on Activity of Apigenin and Genistein Derivatives Against Rabies Virus

Team

- Dr. Ashish Asrondkar (Guide)
- Miss. Pranali Raut (Strip Student)

Funding agency - Haffkine Institute

Duration - November 2021 –April 2022

Abstract

Rabies is a vaccine-preventable, zoonotic, viral disease, mostly transmitted through the saliva of infected domestic dog bites or scratches. 95% of human deaths due to Rabies infection occur in Asia and Africa. Vaccines are only *preventive* measures; only a handful of countermeasures are available for the *grace treatable* period *after* the bite. Literature review suggests that the flavones Apigenin and Genistein are responsible for the anti-rabies activity of an ayurvedic plant, thus making them promising chemical drug candidates as *treatment* measures to *cure* Rabies. This project addresses the first step of this research, the *in silico* analysis, wherein the anti-rabies potential of Apigenin and Genistein ligand drug candidate derivatives developed based on various functional group variations, is evaluated versus a specific section of the target RABV G receptor protein sequence, which will determine the further steps to be taken in the research. Software tools such as AutoDock Vina, online databases such as KEGG PATHWAY, UniProt, RCSB PDB, DrugBank, and online server tools such as ZLab RC plot, UCLA-DOE LAB - SAVES v6.0, NCBI BLAST, Clustal Omega, SWISS-MODEL, Chiron, SCFBio, ProTox-II, admetSAR, SwissADME, SwissDock, and CB-Dock were incorporated as per the devised workflow of this study. The obtained results permit theorising that the selected Apigenin and Genistein drug candidates potentially show exceptional anti-rabies activity.

4. Optimization of Menthol Modified BSA Nanoparticle

Team

- Dr. Ashish Asrondkar (Guide)
- Mr. Vighnesh Shinde (Strip Student)

Funding agency - Haffkine Institute

Duration - January –June 2022

Abstract

Due to inefficient drug transport across the Blood Brain barrier and inefficient drug accumulation in the tumor region, chemotherapy outcomes for the treatment of glioma remain unsatisfactory. Despite the fact that several techniques, including diverse nanosystems, have been developed to promote the distribution of chemotherapeutics in brain tumors, the delivery efficiency and potential damage to normal function still significantly restrict the clinical application of the nanocarriers. As a result, more safe and effective BBB penetration and glioma-targeting strategies are the need of the hour. In the present study, menthol, one of the strongest BBB penetration enhancer discovered in traditional Chinese medicine, was conjugated to BSA, a natural food protein with brain targeting capability. Then the conjugate is desired to self-assemble into the nanoparticles to load anti-cancer drugs. Menthol-BSA conjugate delivers the nanoparticles across the brain capillary endothelial cell monolayer by promoting internalization and BBB disruption. Hence, the penetration ability of menthol-modified BSA nanoparticles is expected to be much deeper than that of unmodified nanoparticles. Therefore, the study combined the advantages of Nanomedicine strategy with modern delivery technology for brain targeting, and is desired to provide a safe and effective approach for glioma therapy.

5. Kinetic and in-silico studies on synthesis of oligopeptides as antiviral drugs for Rabies.

Team

- Dr. Vrushali Patil (Guide)
- Miss. Sarah Shaikh (Strip Student)

Funding agency - Haffkine Institute

Duration - January –June 2022

Abstract

Rabies is a life-threatening encephalitis neurotropic disease which affects humans. This disease is caused by Rabies Virus RV, which is a single stranded negative sense RNA. Currently vaccination is only treatment available for the prevention of rabies. As due to which various treatments involved in this treatments do not give promising results. As a result, there was need to find alternative treatments from when clinical symptoms were observed. The peptides are suitable since they have the ability to mimic ligands and can perform in an antagonistic and agonistic manner. . Its small size, structural diversity and high specificity due to this advantages it can be suitable for treatment. Here in this present work, small oligo peptide chain of Ser-Glu-Gly was studied using in-silico designing and docking studies where binding affinity of -7.02 kcal/mol. Then this chain was synthesized using SPPS technique and monitored with the help of Kaiser test and kinetic study of coupling, and deprotection of –Fmoc group was studied using HPLC technique.



Clinical Pathology

Clinical Pathology

2020-21 and 2021-22



Dr. Shashikant Vaidya

Head of the Department

Overview

Department of Clinical Pathology is one of the oldest department in the institute and was established in the year 1905 & undertook studies on communicable diseases like plague, cholera, Malta fever, typhoid, malaria, diphtheria, relapsing fever.

At present Department is actively involved in Training, Research & Testing activities. Department train students for M.Sc. and Ph.D. degree in Microbiology and Applied Biology (Mumbai University), Ph.D. in Medical Microbiology (MUHS) and Short Term Research Training Program. Department is involved in research on Tuberculosis, Hospital infections, Viral neuro pathogenesis, Herbal compounds, Nanotechnology, Diagnostics, Drug development, Matrix metalloproteinases and Homeopathic Nosodes. The department has well established testing laboratory with different sections like bacteriology, mycology, tissue culture, molecular biology and mycobacteriology as per ISO 9001:2008 and plans to be a NABL accredited according to Institute's policy.

Department tests antibacterial, antimycobacterial and antifungal, post fumigation Operation theatre swabs & microwave disinfection systems. The department comprises of Head of Department, one Scientific Officer, one Senior Technical Assistant, one Laboratory Assistants, one Laboratory Attendant, two doctoral degree (Ph.D.) students and one Master's degree student.

The department is involved in various committees like Institutional Animal Ethics Committee, Purchase Committee, Biosafety Committee, Academic Council, Advisory Council, Executive Committee, Durbar Hall Committee etc. Various students from other departments also work in the department and avail the facilities, with due acknowledgement to the department.

Department has planned training on "Operation Theatre Infection Control and Prevention". Pharmaceutical Microbiology, Basic Techniques in Mycobacteriology and Microbiology and customized training programme.

With its tall vision to develop into a centre with complete solutions for diagnosis of infectious diseases , a state of art laboratory, a recognized and accredited laboratory, a surveillance centre for testing of infectious diseases and a modern training centre.

Dr. S. P. Vaidya, HOD of the department is the nodal officer for the testing of COVID-19 of Haffkine Institute. Other staff is actively involved in the testing of oropharyngeal swabs sent by the various zones for the detection of COVID-19, also they are carrying out data entry work for ICMR related to COVID-19 testing.

Dr. Shashikant P. Vaidya



Departmental Photograph

1. Identification of ligand receptor interactions across blood brain barrier in viral neuro-pathogenesis.(Extramural Funding)

Team

- Dr. Shashikant Vaidya (P.I.) &
- Ms. Durga Bethala (DST-INSPIRE- SRF)

Funding Agency - Department of Science and Technology, Govt. of India

Duration - March 2017- April 2022

Budget - Rs. 24,16,069/-

Abstract

More than 500 million people worldwide are infected each year by any of the four-dengue virus (DENV) serotypes. Dengue serotype 2 (DENV 2) is most predominant in India and other South Asian countries. The clinical spectrum caused during dengue infections is wide and some patients may develop neurological alterations during or after the infection. Clinical evidences suggests that blood brain barrier (BBB) may be compromised during DENV infection; however, it is not clear whether the damage is due to the infection per se or to the inflammatory response activated by the BBB cells. Other neurotropic flaviviruses such as Japanese encephalitis virus (JEV) are also known for neurological damage. JEV uses the bloodstream to enter nerve tissue where it infects cells of the neurovascular unit. Another neurotropic virus like rabies virus (RABV) chooses the retro- grade axonal route to infect the neuronal cells. Both JEV and RABV affect the cells of neurovascular unit in different ways resulting into BBB damage, glial activation and tissue inflammation. Our aim is to study pattern of DENV infection to BBB, compared with other neurotropic viruses like JEV and RABV using in vitro model. In our preliminary study, we observed that the BBB is dysregulated by superinfecting DENV2 activated murine macrophage (RAW264.7) on murine endothelial cells (BEnd3) implying a virus Trojan-Horse mechanism.

2. Quantitative phosphoproteome profiling of circulating influenza virus strains in Mumbai region.

Team

- Dr. Shashikant Vaidya (P.I.) &
- Ms. Pinky Singh (Ph.D. Student)

Funding Agency - Haffkine Institute

Duration - Dec 2017- Dec 2022

Budget - 5 lakhs

Abstract

Influenza virus is a major human pathogen whose genotypic diversity results in unpredictable pandemics and epidemics. Although annual influenza epidemics affect around 10% of the global population, current treatment options are limited and development of new antivirals is needed. Elucidation of host factors required during virus infection provides information not only on the signalling pathways involved but also on the identification of novel drug targets. Quantitative phosphoproteomic will help in revealing the unique phosphoproteome dynamics that occur in the host cell within minutes of influenza virus infection. In this study, Influenza virus isolates would be subjected to PCR for amplification of gene sequences as per WHO primer pairing for quantifying relative viral load. Quantitative phosphoproteomic analysis of human lung carcinoma, epithelial cell line (A549) infected with influenza viruses will be performed at varying time intervals. Harvested cells will be subjected for TEM and flow based studies followed by iTRAQ labelling. Identification and quantitative analysis of iTRAQ- labelled phosphopeptides will be performed using LC-MS/MS.

3. Evaluation of MMP levels in macrophages infected with *Mycobacterium tuberculosis* upon treatment with plant crude extracts

Team

- Dr. Shashikant Vaidya (P.I.) &
- Mr. Kalpesh C. Bavkar (STRIP M.Sc. Student)

Funding Agency - Haffkine Institute

Duration - Dec 2019 – June 2020

Budget - Twenty Five Thousand

Abstract

Tuberculosis (TB) is a respiratory disease which spreads through air from person to person. TB has co-evolved with humans for thousands of years as the oldest known human remains showing signs of tuberculosis infection are 9000 years old. It still remains the critical medical issue. TB disease is established in our body when the bacteria becomes active and start to multiply. Standard TB treatment has remained unchanged since early 1980's. There is an urgent need for new therapies for TB

treatment. This study focuses on the effect of the crude extracts of plant *Cinnamomum verum* on Matrix Metalloproteinase (MMP) levels. MMP's are group of enzymes that in turn responsible for the degradation of most extracellular matrix proteins during organogenesis, growth and normal tissue turnover and also in TB disease. Breakthrough of the extracellular matrix occur for the pathogen to disseminate via the airways and to cause cavity formation, which involves the action of proteases, specifically MMP's. In this study, TB infection is established on murine macrophage cells (RAW 264.7 cell line) which helps in determining its effect on MMP's. The study also determined the cell toxicity of extracts on raw 264.7 cell line. The change in MMP level due to different concentration of the plant extract used has been observed.

Objectives:

1. To prepare crude extracts of *Cinnamomum verum*
2. To perform cytotoxicity assay for the extracts
3. To evaluate MMP levels by ELISA

Results: The plant extracts were tested ranging from 100 mg/ml to 0.01 mg/ml and the absorbance was measured at 550. All four extracts demonstrated considerable viability at all concentration under experimentation. Our plant extracts has the anti-tuberculosis potential and it has been observed experimentally that it has significantly reduced the MMP levels in MTB infected cell line due to the effect of our plant extracts.

4. In vitro determination of anti - tuberculosis activity of *Cinnamomum verum* crude extracts and evaluating cytokine expression in macrophage infected with *Mycobacterium tuberculosis* upon treatment with crude extracts”

Team

- Dr. Shashikant Vaidya (PI)
- Ms. Aishwarya Mahadik (Strip M. Sc. Student (Co-PI)

Funding Agency - Haffkine Institute

Duration - Dec 2019 – June 2020

Budget: Twenty Five Thousand

Abstract

Tuberculosis is an infectious disease which is caused due to *Mycobacterium tuberculosis*. Emergence of new anti-TB drugs is necessary against strain. Since ancient times, certain medicinal plants were used against various infectious disease giving different instances of anti- mycobacterial activity. *Cinnamomum verum* (Cinnamon) was useful for respiratory, digestive and gynaecological illness. Hence, this study would show the ability of *Cinnamomum verum* against *Mycobacterium tuberculosis*.

Objectives

1. To prepare aqueous and organic extract from *Cinnamomum verum* (Cinnamon) plant extract.
2. To determine anti-tuberculosis activity of the plant extract.
3. To determine anti-inflammatory activity by observing cytokine levels (TNF- α and IL-10) in Tuberculosis infected cell line by treatment with bioactive fraction of *Cinnamomum verum*.

Results

The current study is undertaken for determining anti-tuberculosis activity of the plant extract *Cinnamomum verum* (Cinnamon). The cell viability is detected via Resazurin assay which detects amount of viable *Mycobacterium tuberculosis*. The cytotoxicity which refers to ability of certain chemicals to destroy living cells which is then checked by MTT assay. For cytokine expression, effect of aqueous, methanolic and ethanolic extract of *Cinnamomum verum* on Cytokines (IL-10 and TNF- α) levels is observed. ELISA was performed which would show that the level of IL-10 and TNF- α should decrease due to addition of plant extract as many medicinal plants has the ability to suppress the different cytokines levels.

5. In-silico docking of essential oil constituents from *Curcuma caesia* Roxb against *M. tuberculosis*

Team

- Dr. Shashikant Vaidya (PI)
- Ms. Pinky R. Singh (Ph. D. Student)

Funding Agency - Haffkine Institute

Duration - April- 2020 to October-2020

Abstract

Tuberculosis caused by *Mycobacterium tuberculosis*, is one of the leading infectious disease and health burden in the world. The emergence of MDR and XDR variants of the bacilli along with the lack of discovery of novel anti-mycobacterial, poses a serious threat to the management and containment of this global killer. Natural remedies have long played an important role in medicine and continue to provide some inspiring templates for drug design. Essential oils (EOs) have been widely used in medicine. Some of their major components have been shown to be active against *M. tuberculosis*. *Curcuma caesia* is commonly known as kali haldi and it belongs to the family Zingiberaceae. In the traditional system of medicine, fresh and dried rhizomes of *Curcuma caesia* Roxb are used in treating leucoderma, asthma, tumours, piles, bronchitis, bruises, etc. In this study, we used a molecular docking approach to investigate the interactions between selected phytoconstituents of essential oils (EOs) from rhizome of *Curcuma caesia* Roxb. against three 'druggable' proteins involved in vital physiological functions in *M. tuberculosis*, namely MtPanK, MtDprE1 and MtKasA. The docking score for ligands towards each protein was calculated to estimate the binding free energy, with the best docking score (lowest energy value) indicating the highest predicted ligand/protein affinity.

6. Activity of various rhizome extracts of Black turmeric against tuberculosis and drug resistant bacteria.

Team

- Dr. Shashikant Vaidya (PI)
- Shasanka Rabindra Sahu (STRIP M.Sc. Student)

Funding Agency - Haffkine Institute

Duration - Jan 2021- June 2021

Budget - Twenty Five Thousand

Abstract

Mycobacterium tuberculosis (MTB), the causative agent of the infectious disease tuberculosis, has been a source of concern for over a decade due to the pathogenic nature of the bacterium. The ability of the bacteria to evolve and develop strains that are resistant to modern drugs have created a need to turn towards the ancient knowledge of Ayurveda. In recent times, WHO has agreed to the fact that the use of Ayurveda in treating the disease has proven to be beneficial and effective. *Curcuma caesia* (Black turmeric) has been used for treating tuberculosis like symptoms by various tribes in the rural India. The fresh rhizome extract of Black turmeric has been proven to have anti-inflammatory, antimicrobial, anti-rheumatic, anti-venomous, antiviral, anti-diabetic as well as anti-cancerous properties. In the study, the effect of the phytoconstituents present in the rhizome extract of *Curcuma caesia* will be evaluated against tuberculosis/drug resistant bacteria. Cytotoxicity assay will be performed on U937 and raw cell lines. Since, these cell lines are proven to be useful model in the MTB drug development. The phytoconstituents will be analyzed using GC-MS. *In-silico* docking study will allow us to understand the effect of the phyto compounds against specific target proteins. Which can be further verified using *In-vitro* assays.

Objectives:

- Phytochemical screening of *Curcuma caesia* extracts/fractionates.
- In-vitro cytotoxicity analysis of various extracts against cell lines.
- To study the effects of various extracts on Gram positive and Gram negative bacteria.
- To study the effect of various extracts on tuberculosis/drug resistant bacteria.
- To study anti-fungal activity of various extracts on fungal strain.

Results:

Phytochemical assay results:

The analysis of phytochemicals present in the plant extract was carried out by the standard protocol.

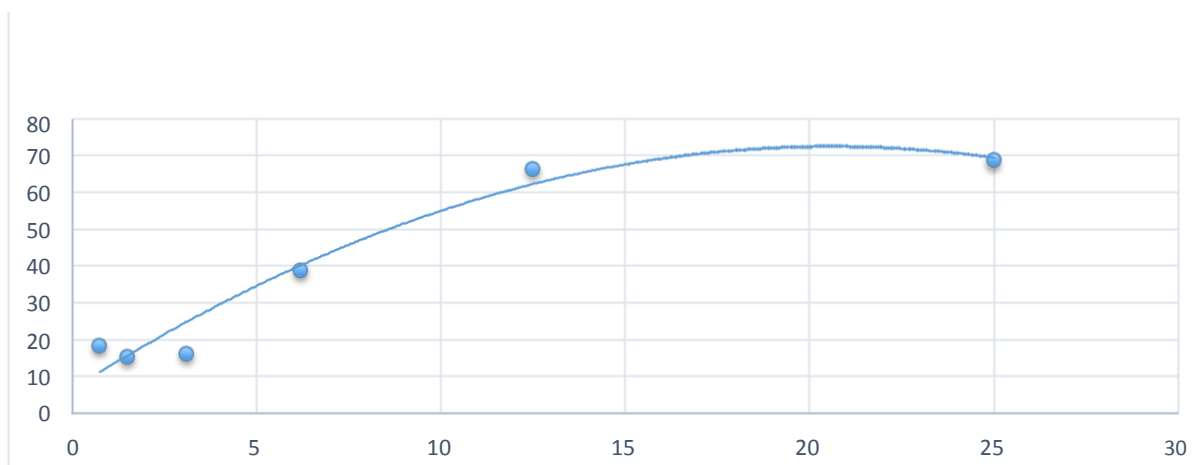
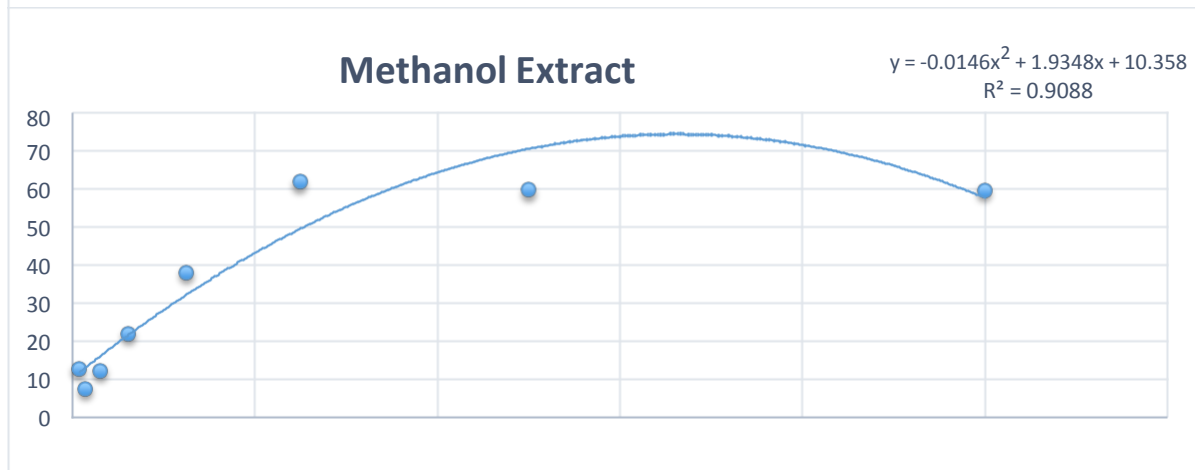
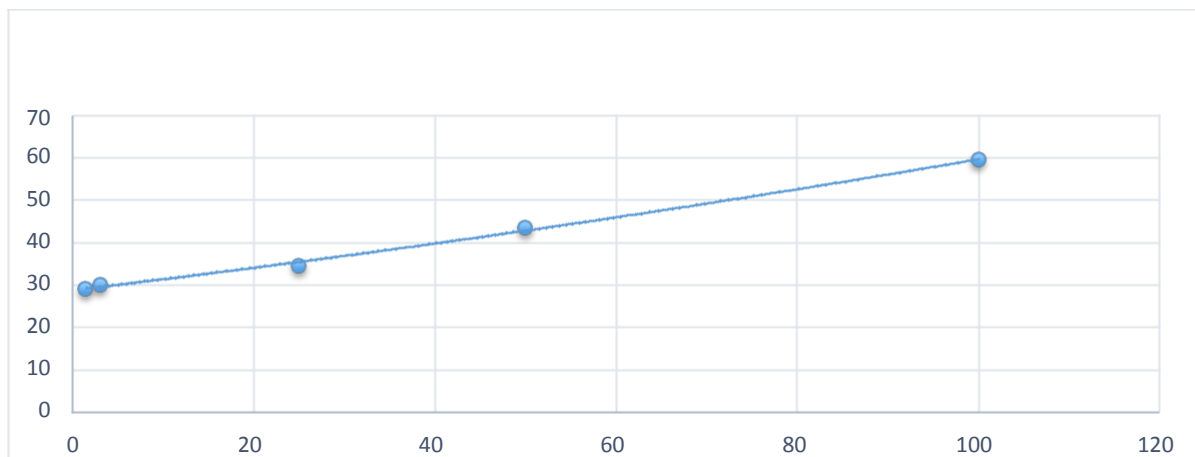
The analysis showed following results:

Sr. No.	Procedure	Phytochemical	Inference
1	2ml of 2.0% NaOH + 1ml crude	Flavonoids	Yellow coloration shows
	plant extract.		presence of flavonoids.
2	2.5ml of plant filtrate + 5ml	Saponins	Froth formation confirms
	Distilled water + heat.		presence of Saponins.
3	2ml of chloroform + 5ml extract.	Terpenoids	Grey coloration shows presence
	Evaporate on water bath + 3ml		of terpenoids.
	conc. H ₂ SO ₄ .		
4	2ml of chloroform + 2ml conc.	Steroids	Red color in the lower level of chloroform indicates the presence of steroids.
	H ₂ SO ₄ + 5ml extract.		
5	1ml extract + 1ml conc. H ₂ SO ₄	Proteins	White ppt indicates the presence
			of proteins.
6	2ml extract + 3ml 10% NaOH.	Coumarins	Yellow coloration shows the
			presence of coumarins.
7	1ml extract + 1ml conc. H ₂ SO ₄	Quinones	Formation of red color indicates
			that quinones are present.
8	2ml extract + 0.1ml dil. NaOH	Volatile oil	
	+ dil. HCl.		
9	2ml of acetic acid + 2ml of chloroform + 2ml extract.	Glycosides	Appearance of green color shows the presence of glycosides.

Table 01: Phytochemical Assay Protocol

Cell cytotoxicity assay or MTT assay was performed using a 96 well plate and the results were observed as follows:

MTT Graph (RAW cell line)





7. Developing Coronavirus Nosode and evaluation anti-viral potentials of the Nosodes and other homeopathic drugs (Extramural Funding)

Team

- Dr. Rajesh Shah (PI)
- Mrs. Geetanjali Talele (Co-PI)
Life Force Foundation Trust
- Dr. Shashikant P. Vaidya (Co-PI)
- Dr. Sandeepan Mukherjee (Co-PI)

Funding Agency - Life Force Foundation Trust.

Duration - Jan 2021- June 2021

Budget - Two Lakhs

Objectives

Preparation and standardization of homeopathic nosode using corona virus (Clinical Sample).

Evaluating anti-viral potential (through immunomodulatory action) of corona virus nosode as well as other potential drugs.

Nosodes

Nosode are homeopathic medicines prepared from the organism (bacteria, virus, fungi etc) or diseased tissues. About 45 such nosodes are in use since over 150 years against many infections and other diseases, Nosodes are used as preventive and curative against many infections, Some examples of nosodes include Tuberculinum (from TB germs), Psorinum (from Scabies parasites), Medorrhinum (from Gonorrhea germs), Variolinum (from smallpox virus), Lysine (from Rabies virus). Carcinisin (from Cancer tissues) and more

Preparation

- Identification of source of virus for preparation of nosode.
- Characterization of the source material.
- Preparation of original stock nosode using HPI guidelines.
- Preparation of potencies by standard methods.

Expected Outcome:

A reproducible standardized nosode developed with modern techniques could be used as a preventive and therapeutic measure against corona virus infections and other conditions. A breakthrough solution against corona virus. Opening avenues for fighting against such epidemics and pandemics in future.

Future plan department:

Testing:

On the recruitment of Pathologist in the institute, serological, hematological and microbiological testing of clinical samples will be restarted.

Training:

Training program in “Industrial Microbiology” for three months duration

Research:

Development of ant tuberculosis agents from herbal compounds

Covid -19 testing contribution (2020-21)

The following departmental personnel contributed to the Covid-19 testing activities in the Institute from April 2020 to August 2021

Sr. No.	Staff / Student	Type of Work
1	Dr. Shashikant P. Vaidya (HOD)	Nodal Officer
2	Mrs. Vibhuti A. Thakur (Scientific Officer)	Sample preparation, RNA extraction, Pre – PCR work and documentation
3	Mrs. Swati Sanap (S.T.A)	Sample preparation, RNA extraction, Pre – PCR work and documentation.
4	Mr. Ravikant Khochare (Laboratory Assistant)	Laboratory support work and documentation
4	Mr. Avinash More (Laboratory Attendant)	Laboratory support work
5	Ms. Durga Bethala (Ph.D. student)	Sample preparation, RNA extraction and PCR work
6	Ms. Pinky Singh (Ph.D. student)	Sample preparation, RNA extraction and PCR work
7	Mr. Kalpesh Bavkar (M.Sc., STRIP student)	Sample preparation, RNA extraction, Pre-PCR work

1. Identification of ligand receptor interactions across blood brain barrier inviral neuro-pathogenesis.(Extramural Funding)

Team

- Dr. Shashikant Vaidya (P.I.) &
- Ms. Durga Bethala (DST-INSPIRE-SRF)

Funding Agency - Department of Science and Technology, Govt. of India

Duration - March 2017- April 2022

Budget - Rs. 24, 16,069/-

Abstract

More than 500 million people worldwide are infected each year by any of the four-dengue virus(DENV) serotypes. Dengue serotype 2 (DENV 2) is most predominant in India and other SouthAsian countries. The clinical spectrum caused during dengue infections is wide and some patientsmay develop neurological alterations during or after the infection. Clinical evidences suggests thatblood brain barrier (BBB) may be compromised during DENV infection; however, it is not clearwhether the damage is due to the infection per se or to the inflammatory response activated by the BBB cells. Other neurotropic flaviviruses such as Japanese encephalitis virus (JEV) are alsoknown for neurological damage. JEV uses the bloodstream to enter nerve tissue where it infectscells of the neurovascular unit. Another neurotropic virus like rabies virus (RABV) chooses theretro-grade axonal route to infect the neuronal cells. Both JEV and RABV affect the cells of neurovascular unit in different ways resulting into BBB damage, glial activation and tissueinflammation. Our aim is to study pattern of DENV infection to BBB, compared with other neurotropic viruses like JEV and RABV using in vitro model. In our study, we observed that the BBB is dysregulated by superinfecting DENV2 activated murine macrophage(RAW264.7) on murine endothelial cells (BEnd3) rather upon direct virus infection.

2. Quantitative phosphoproteome profiling of circulating influenza virus strains in Mumbai region.

Team

- Dr. Shashikant Vaidya (P.I.) &
- Ms. Pinky Singh (Ph. D. Student)

Funding Agency - Haffkine Institute

Duration - Dec 2017- Dec 2022

Budget - 5 lakhs

Abstract

Influenza virus is a major human pathogen whose genotypic diversity results in unpredictable pandemics and epidemics. Although annual influenza epidemics affect around 10% of the global population, current treatment options are limited and development of new antivirals is needed. Elucidation of host factors required during virus infection provides information not only on the signalling pathways involved but also on the identification of novel drug targets. Quantitative phosphoproteomic will help in revealing the unique phosphoproteome dynamics that occur in the host cell within minutes of influenza virus infection. In this study, Influenza virus isolates would be subjected to PCR for amplification of gene sequences as per WHO primer pairing for quantifying relative viral load. Quantitative phosphoproteomic analysis of human lung carcinoma, epithelial cell line (A549) infected with influenza viruses will be performed at varying time intervals. Harvested cells will be subjected for TEM and flow based studies followed by iTRAQ labelling. Identification and quantitative analysis of iTRAQ-labelled phosphopeptides will be performed using LC-MS/MS.

3. Gene expression studies of influenza virus-infected host cells.

Team

- Dr. Shashikant Vaidya (P.I.) &
- Ms. Sarah Khatkhatay (STRIP M.Sc. Student)

Duration - Jan 2022 – June 2022

Budget - Twenty Five Thousand

Abstract

Influenza viruses can be classified into dozens of subtypes based on their hemagglutinin (HA) and neuraminidase (NA) proteins. To date, 18 HA subtypes and 11 NA subtypes of IAVS that spread in animals and humans have been found. Following infection, the IAV first induces the innate immune system, which can rapidly recruit innate immune cells and cytokines to the site of infection. Influenza induced cytokine storms have been associated with uncontrolled proinflammatory responses, which may lead to significant immuno-pathy and severe disease. Cytokine storms are complicated by several types of cytokines and chemokines that have various activities. In addition to their direct effects their cross regulation causes cytokine networks to form; these networks determine the outcome of viral infections. In this project, we focus on cytokine storms and the genes that are triggered by the different subtypes of influenza virus.

4. Genotypic characterization of MRSA (Methicillin Resistant Staphylococcus aureus) isolated from touch sites of Mumbai Suburban Railways

Team

- Dr. Shashikant Vaidya (P.I.) &
- Ms. Aditi Rauthmare (STRIP M.Sc. Student)

Duration - Dec 2021 – May 2022

Budget - Twenty Five Thousand

Abstract

Microbes in public areas can be a critical issue in public health because of the ease of the transfer of pathogens from individual to individual. Public transportation systems particularly in Mumbai suburban trains can facilitate the transmission of microbes to a large number of people. This is a particular public health concern when microbes are drug-resistant and pathogenic. While many drug resistant pathogens are primarily nosocomial, some are increasingly community-acquired, including Methicillin-resistant Staphylococcus aureus (MRSA). With knowledge of heavy commuter load on Mumbai suburban railways, Investigation of MRSA contamination level will be conducted focusing solely on various touch surfaces in local trains. The data of MRSA contamination in public transport in Mumbai region is missing. Further characterization of MRSA isolates will be done to understand genotypic and phenotypic characteristics.

5. Investigation of the Anti-TB activity of a crude plant extract on mammalian cell lines.

Team

- Dr. Shashikant Vaidya (P.I.) &
- Ms. Ragini Mahajan (STRIP M.Sc. Student)

Duration - Jan 2022 – June 2022

Budget - Twenty Five Thousand

Abstract

Mycobacteria are slow growing organisms that require administration of a combination of drugs for extended periods to achieve effective therapy and to prevent the emergence of resistance. The risk of adverse reactions therefore must be a major consideration in drug selection. Apart from significant toxicity, lengthy therapy also creates poor patient compliance. Non-compliance is a frequent cause of a deadly multidrug resistant TB (MDR-TB) and extensively drug resistant TB (XDR-TB). Drug toxicity coupled with the problem of mycobacterial persistence highlights the need to develop novel TB drugs that are active against drug resistant bacteria and kill persistent bacteria as well as shorten the length of TB treatment. Our study aims to exploit the natural plant material, as standardized plant extracts, provide unlimited opportunities for new drug leads because of the unmatched availability of chemical diversity. Furthermore, in order to understand the pathogenesis of M. tuberculosis infection on a molecular level, it is essential to understand the clinical behaviour of this pathogen in its only natural host cells and the protein expression elicited upon infection will assist in evaluating the immunological profile associated with the same.

6. Newton Bhaha PhD Placement Programme

Team:

- Dr. Olena Riabinina (PI)
Assistant Professor, Department of Biosciences, Durham University, UK
- Dr. Shashikant Vaidya (Co-PI)
Assistant Director & HOD, Clinical Pathology Department
- Ms. Durga Bethala, DST-INSPIRE-SRF

Funding Agency –

The grant is presented by the Department of Business Energy & Industrial Strategy (BEIS), UK & Ministry of Science and Technology, India, along with the British Council, India and the Department of Science and Technology (DST).

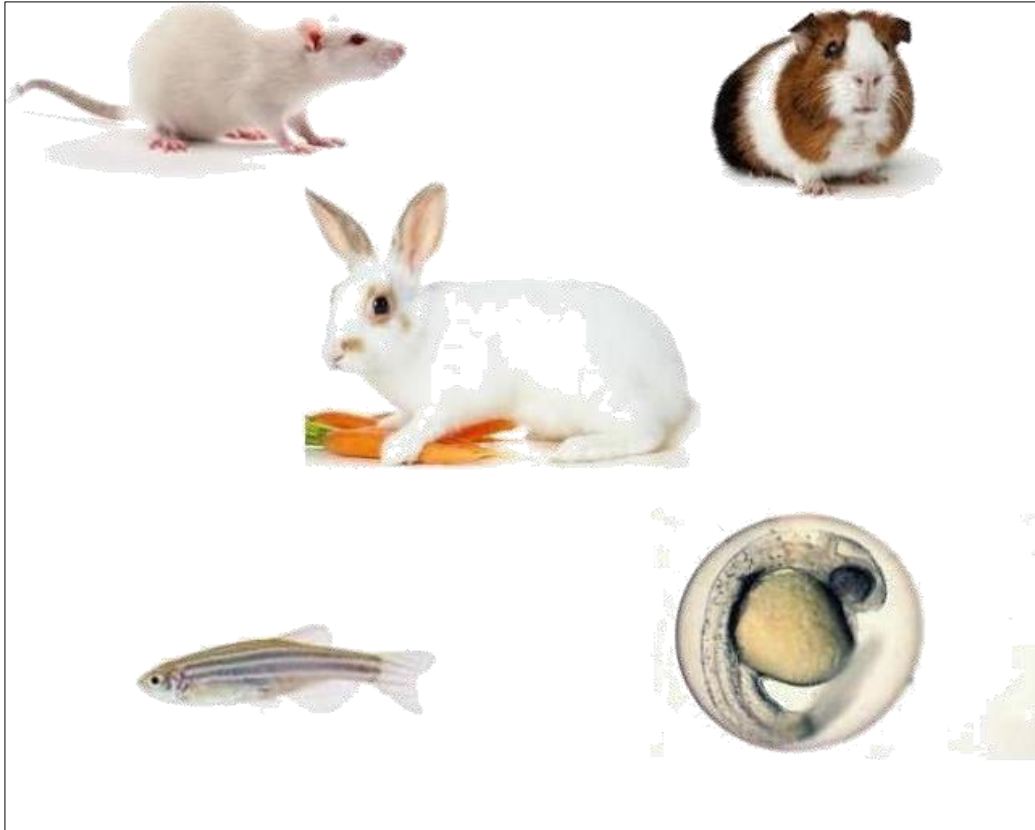
Project Duration - September 2021- January 2022

Budget - GBP 10200 (BEIS) and Rs.1, 15,000 (DST) or Rs.11, 55,160/-
(Total Amount if converted in INR)

Abstract

The in-silico protein-protein docking data suggest that dengue envelope protein has affinity towards neuronal transmembrane receptors. Based on lowest energy score, plasma lemma vesicle associated protein, annexin A6 and vacuolar protein sorting associated protein-13C have shown higher interaction to dengue envelope protein as compared to other neurotropic viruses. The preliminary in- vitro results suggest that the DENV activated microglia increases the vascular permeability of the endothelium, leading to BBB disruption. DENV infection appears to boost the oxidative stress in murine endothelial cells, as seen by an extensive upregulation of Nitric oxide synthase (iNOS), in turn damaging the basal lamina of these BBB cells. Overall, it is apparent that though microglia aid in the impairment of the BBB, their chief role is to recruit the peripheral monocytes and macrophages towards site of infection. So far, my work was conducted using in-vitro mouse model whereas the proposed placement would help me to establish the in-vivo BBB disruption model in Drosophila. Our main aim is to develop a Drosophila model to study blood-brain barrier (BBB) integrity during viral infection. The molecular mechanisms that regulate the integrity of the BBB are similar between flies, mice, and humans, but are much easier to study in flies, due to the low costs of fly maintenance, vast available genetic tools, and high throughput screening. This would help in assessing different viral diseases causing neuropathogenesis for future studies. The main research aim of this placement is to develop a Drosophila model to study blood-brain barrier (BBB) integrity. Matrix metalloproteinases (MMP1 and MMP2) are crucial factors that

can digest basement membrane proteins and Tight Junction proteins (TJ), thus affecting the integrity of the BBB in *Drosophila*, leading to virus invasion. Reactive Oxygen Species (ROS) directly downregulate TJs and indirectly activate MMPs that promote the opening of the BBB in murine microglial cells. In the current work on murine endothelial cell line, we found that dengue virus alters the BBB vascularity by increasing the expression of MMP2 and MMP9 and decreasing expression of TJ (Occludin). Oxidative stress is also implicated as a contributing mechanism to the overall effects of BBB deterioration. So, we wanted to know whether iNOS and MMP2 has the same effect on other organisms like it has on invitro mice model. Therefore, we tried to analyse whether the upregulation or downregulation of iNOS and MMPs has any effect on *Drosophila* fly model. The fly model provides us to do real- time study on physiological live system but it's also much simpler and easier to handle than mice and has lower maintenance cost. In the proposed UK placement project, we will regulate the abundance of a ROS, Nitric Oxide, by genetically manipulating the levels of ROS in BBB cells, glia. For this, four genetic lines will be used to target different glia types (repo-GAL4 (all glia), moody- GAL4 and Rab9-GAL4 (subperineural glia), NP 6293 - GAL4 (perineural glia) and cross them to one of the 3 transgenic lines to upregulate (UAS- NOS and UAS-macNOS) or downregulate (UAS-NOS-RNAi) production of nitric oxide synthase (NOS), and thus nitric oxide itself. By crossing the different *Drosophila* genetic lines, we developed different fly transgenic lines having super-expressed, moderately expressed, and low-expressed iNOS in fly brain. We tried to assess whether change in inducible nitric oxide synthase (iNOS) level has impact on the *Drosophila* BBB integrity and does *drosophila melanogaster* matrix metalloproteinases (dmMMP) has any role in aiding the barrier impairment. We used immunostaining, transmission electron microscopy and real-time polymerase chain reaction (PCR) for our current study. We observed that iNOS and dmMMP has some impact on collapse of BBB by increasing the permeability and downregulating the septate junction protein in fly brain. This in-vivo study proves that change in iNOS levels effects the MMP expression, whose levels are crucial factor in determining the extent of BBB damage.



Toxicology

Toxicology

2020-21 and 2021-22



Mrs. Swati Mumbarakar

In charge of Department
03/03/2020 to 17/12/2020



Dr. Mrunal Ghag-Sawant

Head of Zoonosis Department
18/12/2020 to 31/03/2022

Overview

Toxicology is the study of adverse effects of chemical substances on living organisms and their environment. It is a dynamic multi-disciplinary science that required interactions between biology, chemistry, medicine, veterinary science, pharmacy and environmental biology. Over the past few years, toxicology has played a vital part in drug development. For more than 20 years, the Department of Toxicology and the Institute has been providing services for the comprehensive toxicity testing studies for registration of pharmaceuticals, agrochemicals, biocides, cosmetics, chemicals and related products. Majorly *in vivo* toxicity testing is conducted in the Dept., which is as per the regulatory requirements of the OECD, ICH, FDA, EMEA, OPPTS, BIS and/ or ISO 10993.

Training of the staff in conducting 'in vivo' toxicity testing in small vertebrate zebrafish is in progress. The staff members themselves actively participate in the in-house and external training programmes.

Future Plan

1. To establish GLP compliance testing and research laboratory
2. Up gradation of laboratory facility for *C.elegans* for research purpose

Projects

Zebra fish facility approved by IAEC (Institutional animal Ethics Committee) on 18/12/2020.

Testing

Services offered for pre-clinical in vivo toxicity testing include following tests.

- i. Acute oral toxicity in rats/ mice
- ii. Acute Oral LD50 in rats/ mice
- iii. Sub-acute oral toxicity in rats/ mice
- iv. Repeated dose toxicity study in rats/ mice (90 day)
- v. Acute dermal irritation/ corrosion test in rabbits
- vi. Acute dermal LD50 in rabbits.
- vii. Sub-acute dermal toxicity in rabbits /rats (28 day)
- viii. Mucus membrane irritation in rabbits
- ix. Skin sensitization test in guinea pigs.
- x. Fish acute toxicity test
- xi. Fish early life-stage toxicity test

Covid testing (2020-21):

The first case of COVID-19 in India, which originated from China, was reported on 30 January 2020. In March, after the lockdown was imposed, still Haffkine Institute was working as frontline supporters for government of Maharashtra for COVID-19 testing. Department of Virology took initiative in testing of COVID-19 samples. However, due to insufficient manpower in virology department, scientist and staff of department of toxicology wholehearted participated in supporting and testing of COVID-19 samples since March 2020 onwards till date along with handling routine departmental testing.

Dr. Mrunal Ghag-Sawant



Department Photograph

Departmental Activity



Oral Dosing in rat



Nasal Discharge in rat



Dermal Toxicity study in rabbits

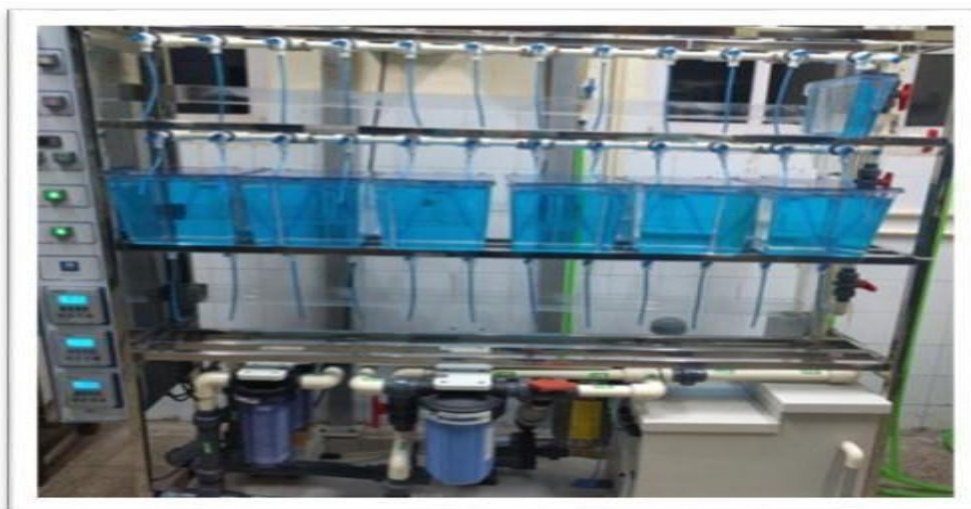


Microscopic observation of Zebra fish larvae



Artemia hatchery

Core Facilities



Zebra fish facility



Fig 1-Aegis Bio Zebra fish facility



Fig-2 Timer: To maintain 14hrs light and 10hrs Dark Cycle



Fig 3-Control Box: Showing Indicator, Water pump, Air pump, Heater, water pump,



Fig 4 -Control Box: Showing Indicator, Dissolved Oxygen and conductivity



Fig 5- Artemia Hatchery



Fig 6- Advanced stereo and stereo microscope

1. Preclinical assessment of macrophage receptor targeted micro particles of three anti-tubercular drugs in healthy rats - acute toxicity, pharmacokinetics and bio distribution by inhalation route

Team

- Dr. Mrunal Ghag Sawant (PI)
- Mrs. Swati U. Mumbarkar (Team Members)
- Mrs. Meenal Mulkutkar (Team Members)
- Ms. Hemali Savla (BCP Ph. D. Student)

Funding agency - Academic Research/ Testing -- Department of Pharmaceutics,
MSB's Bombay College of Pharmacy, Mumbai, India.

Duration - 1st October 2021 - 30th September 2022

Budget - 2,83,332.00 INR

Abstract

Tuberculosis (TB) is caused by the intracellular pathogen, *Mycobacterium tuberculosis* (*M. tb.*). The major challenge in oral TB therapy is achieving high drug concentrations in alveolar macrophages (AMs), the cells where the TB bacilli reside. Pulmonary delivery of alveolar macrophage receptor targeted carrier systems for anti-TB drugs formulated as dry powder inhalation system can be expected to help deliver higher concentrations and achieve enhanced uptake of the drugs into the macrophages and efficiently kill intracellular tuberculosis bacilli and, thus, curb the infection at its portal of entry, that is, lungs. The present investigation is designed to investigate the developed macrophage receptor targeted micro particles of three anti-TB drugs for their acute toxicity, pharmacokinetics and bio distribution upon intratracheal administration in healthy rats. The data will be used to calculating inhalation doses of the developed formulations for studies in infection model.

Phase I – Acute toxicity of TB drugs completed and there was no toxicity or adverse effect found in acute inhalation study.



Intratracheal administration of test substance



Dissection and organ collection

2. Development of Targeted Inhalation Systems for Improved Therapy of Tuberculosis

Team

- Dr. Mrunal Ghag Sawant (PI)
- Mrs. Swati U. Mumbarkar (Team Members)
- Mrs. Meenal Mulkutkar (Team Members)
- Ms. Isha Naik (Ph. D. Student)

Funding agency - Academic Research/ Testing -- Department of Pharmaceutics,
MSB's Bombay College of Pharmacy, Mumbai, India.

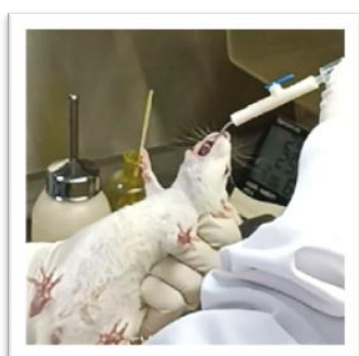
Project Duration - 1st October 2021 - 30th September 2022

Budget - 2,50,296.00 INR

Abstract:

Tuberculosis (TB) caused by the intracellular pathogen, *Mycobacterium tuberculosis* (M.tb), is a global challenge; major problem is to achieve high drug concentrations in alveolar macrophages (AMs). Pulmonary delivery of anti-TB drugs (ATDs) in a carrier system: Capable of being recognized by mannose receptors (abundantly expressed on AM surface) and efficiently endocytosed by AMs can be promising to improve intracellular chemotherapy. To understand the safety, pharmacokinetics and bio distribution of the developed formulations in rats after delivery by the intratracheal route.

Phase I – Acute toxicity of TB drugs completed and there was no toxicity or adverse effect found in acute inhalation study.



Intratracheal administration of test substance



Retro orbital site blood collection

3. “Toxicity and Anti-Inflammatory Activity of 2- nitrothiazole”

Team

- Dr. Mrunal Ghag Sawant (PI)
- Mrs. Swati U. Mumbarkar (Co-PI)
- Mrs. Meenal Mulkutkar (Team Member)
- Mr. Shubham Kalaskar (Strip Student)

Funding agency - Haffkine Institute

Project Duration - 1st November 2021 - 30th April 2022

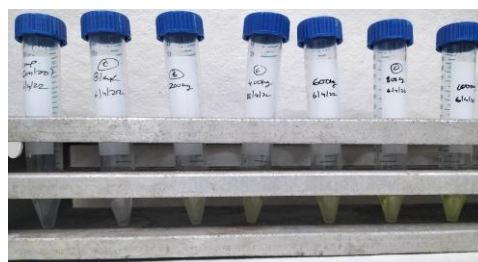
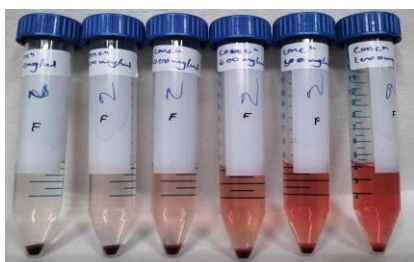
Approved By - IAEC

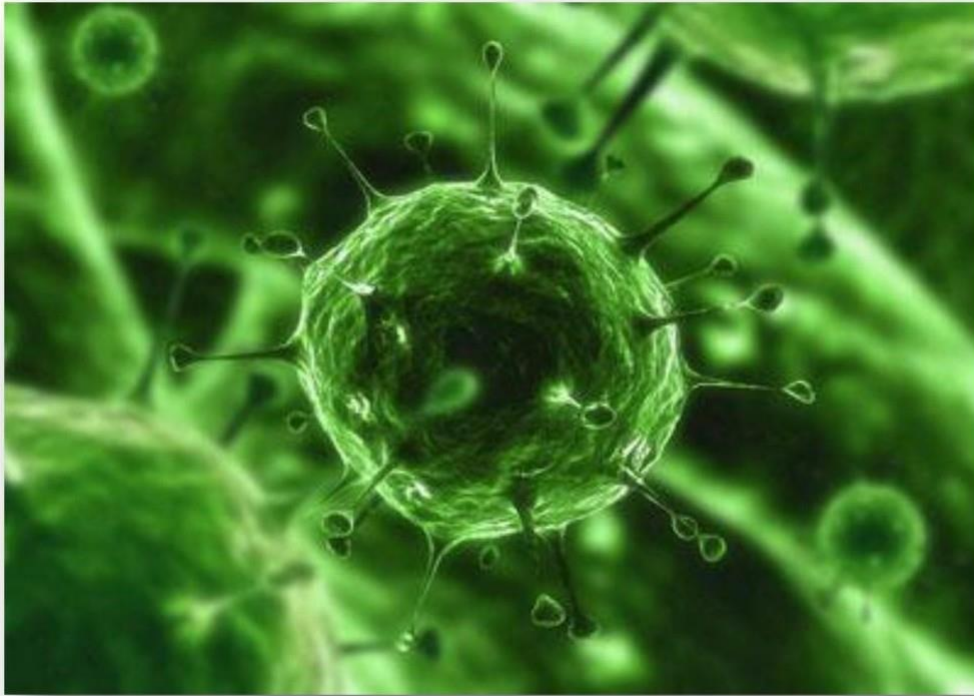
Abstract

Inflammation is a biological immune system response that can be triggered by a number of factors such as pathogens, damaged cells, and toxic compounds. These factors have the potential to cause acute and/or chronic inflammatory responses in the heart, pancreas, liver, kidney, lung, brain, intestinal tract, and reproductive system, potentially resulting in tissue damage or disease. Infectious and non-infectious agents, as well as cell damage, activate inflammatory signaling pathway, the most common of which are the NF-B, MAPK, and JAK-STAT pathways. The cytotoxicity assay widely used in toxicological studies. MTT assay is a laboratory test and a standard colorimetric assay (an assay that measures colour change) used to measure the activity of enzymes that convert MTT to formazan, which results in a purple colour. Because this occurs primarily in mitochondria, it is a direct indicator of mitochondria activity. It can also be used to evaluate the cytotoxicity of potential pharmaceutical drugs and other toxic substances. The aim of this study was to determine the toxicity and anti-inflammatory activity of 2-nitrothiazole. The *In silico* Studies were studied for the 2-Nitrothiazole and Diclofenac, where it was docked, as it is a preliminary test used to predict the toxic dose, further the Zebrafish embryo toxicity test was performed where the newly fertilized eggs were exposed to the different concentration for 96 h for each 24h of intervals the embryo were observed for any mortality and the LC50 values were calculated. We have also checked for inflammation induced by chemical model such as treatment with 2-Nitrothiazole and Diclofenac, also the evolution of the anti-inflammatory property of the chemical used in inflammation was estimated by *In-vitro* method i.e. HRBC membrane stabilization and Albumin Denaturation method was used and were compared with the standard drug i.e. Diclofenac and observed which compound signifies good% Inhibition.

Result

The compound was non-toxic below the concentration of 31.25 $\mu\text{g/mL}$ and test solutions below this concentration were used for in vivo studies. The LC₅₀ value was found to be 1.5 $\mu\text{g/L}$ from toxicity test done on zebrafish embryos. The concentration of 200 $\mu\text{g/mL}$ and 1000 $\mu\text{g/mL}$ showed highest protection in HRBC and Protein Denaturation Assay respectively. But the percentage protection was less as compared to the standard anti-inflammatory drug Diclofenac.





Virology

Virology

2020-21 and 2021-22



Dr. Sandeepan Mukherjee
Head of the Department

Overview

Department of Virology is one of the older departments of Haffkine Institute, engaged for the past 95 years in understanding the epidemiology, pathophysiology and host immune response towards various viral diseases. It is a National Influenza Centre recognized by the WHO. Currently, it is a network laboratory under the NCDC-IDSP Influenza-like Illness Surveillance. Neurovirology, Retrovirology, Vector-borne Virology and Respiratory Virology are the current thrust areas of the Department. Research is undertaken on understanding the virus-host relationship and its implication on public health. Studies related to anti-viral efficacy analyses of novel chemical entities (NCEs) of both synthetic and natural origin are undertaken. The department is also engaged in repurposing of drugs as antiviral agents. These evaluations have both academic as well as commercial outcomes.

The Department organizes an annual Hands-on Training in Techniques in Virology and Immunology.

Testing includes diagnosis of viral infections like COVID-19, Influenza and Rabies by classical and molecular virology. The Department is engaged in identifying the immune response to various viral and non-viral entities, by means of genomic or proteomic analysis. Here, differential expression of immune parameter genes; (e.g. Cytokines, chemokines, growth factors, BBB proteins); as well as proteins in various infections, is studied. The Department also plans to set up in-vitro models for evaluating inflammation, immune-modulation and specific toxicity. The department also undertakes testing for validation of virucidal activities of disinfectants.

From March 2020 the Department of Virology setup the lab and coordinated the molecular diagnosis of COVID-19 in Haffkine Institute.

A team of four technical and four support staff facilitate the routine tasks of the Department. Mr. Shishupal Kamble and Mr. Hemant Salvi were deputed for COVID-19 duties from the Administration section to the Department of Virology during this period.

Dr. Sandeepan Mukherjee



Departmental Photograph

Research Projects 2020-21

1. Assessment of modified protocol to determine virucidal activity of disinfectants.

Team

- Mr Cleon D'souza, (STRIP Student)
- Mr. Pavankumar Todkar,
- Dr. Sandeepan Mukherjee

Funding Agency - Haffkine Institute

Duration - Jan 2021 – July 2021

Budget - 25 Thousand

Abstract

To determine the effect of a compound/ drug on a virus there are two well established methods that can provide results on the amount of virus reduction. These methods are the Tissue Culture InfectiousDose 50 or TCID50 assay and Plaque forming assay. There is one area in these assays that has been a cause of multiple errors and that is the final stage of the assay where the human eye is used to observe the cytopathic effect aka CPE. The human eye in all of its evolutionary glory is in no way perfect and precise; varying from person to person in multiple aspects. This factor makes the final stage an area of variance from one observer to another. Another problem that arises during these assays is the absence of CPE of some virus types on cells making it difficult to interpret the log reduction. To avoid all of these problems and to make result interpretation even more precise a step of q RT-PCR to identify the presence of viral RNA in the cultured cells will be added. This will provide results similar to that of a CPE except it will be in the form of presence or absence of viral RNA. Therefore, the results of the PCR will show if the virus was reduced in a particular dilution or not by the presence or absence of an amplification plot. The earlier stages of this study will follow the anti-viral assays protocol to the T thereby, making it evident that there is no fault in the assay. Only the final stage will be modified to a SYBER based and one step qRT. The results that will be obtained from this alteration will not be different or novel in any manner; instead, the results can be applied to the formulas derived by Spearman-Kärber or by Reed and Munch to determine the log reduction. This will be possible because this PCR reaction is qualitative which is the same type of reading required in the formulas mentioned above.

2. Assessment of potential viral activity of known Antiparasitic agents

Team

- Ms. Shruti Karkare (STRIP Student)
- Dr. Sandeepan Mukherjee

Funding Agency - Haffkine Institute

Duration - Jan 2021 – July 2021

Budget - 25 Thousand

Abstract

The influenza virus is notorious for causing large scale epidemics and the occasional pandemics. In the last century, influenza has caused 4 major pandemics, causing excessive morbidities and mortalities. Although vaccines and chemotherapeutic interventions are available, the constant mutations that are observed in the virus, needs regular upgradation of the vaccine formulation. Also, the novel chemotherapeutic interventions needed to encounter the drug resistance that is brought about by the mutation. Repurposing of available licensed drugs as antivirals has been proven to be much effective in the management of many viral infection. The present study was carried out to investigate the potential of certain selected antiparasitic agents as potential anti- influenza antivirals. Structures of influenza virus proteins were obtained from PDB. They were docked with the structures of the antiparasitic drugs obtained from PubChem, using AutoDock Vina software. Oseltamivir was used as a standard. IVE exhibited the binding energies of -8.6 Kcal/mol with neuraminidase protein 3TI6, 135 Kcal/mol with nucleoprotein 2IQH, -7.5 Kcal/mol with hemagglutinin protein. ALB exhibited the binding energies of -6.1 Kcal/mol with neuraminidase protein 3TI6, -5.4 Kcal/mol with nucleoprotein 2IQH, -6.5 Kcal/mol with hemagglutinin protein. MET exhibited the binding energies of -4.9 Kcal/mol with neuraminidase protein 3TI6, -5.3 Kcal/mol with nucleoprotein 2IQH, -5.5 Kcal/mol with hemagglutinin protein. MEB exhibited the binding energies of -6.5 Kcal/mol with neuraminidase protein 3TI6, -6.1 Kcal/mol with nucleoprotein 2IQH, -7.3 Kcal/mol with hemagglutinin protein. The pH1N1 strain of the influenza virus was cultured on MDCK cells. Antiviral assays were carried out in the same system. Standard virus was incubated in the presence of the drugs for 72 hours. Hemagglutination assay was performed to determine the log reduction in virus titre if any. IVE, ALB, MET and MEB all exhibited $4 >$ log reduction. All the drugs used in the study exhibited promising anti-influenza virus activity in the preliminary studies. They may therefore be considered as potential candidates for the preclinical and clinical studies on influenza so that they may be used in the clinics during influenza virus infections.

Research Projects 2021-22

1. Laboratory surveillance of Influenza like Illness and severe acute respiratory illness (ILI-SARI) in India (Extramural Funding) 2020-21 and 2021-22

Team

- Ms Seema Vyas,
- Dr. Sandeepan Mukherjee,
- Mr. Pavankumar Todkar

Funding Agency - National Centre for Disease Control, Govt. of India, New Delhi.

Duration - NCDC 2009 Onwards

Budget - 11.20 Lakhs per year

Abstract

Influenza viruses are highly contagious, causing acute respiratory illness and afflicting humans since ancient times. World Health Organization (WHO) declared first pandemic of the 21st century caused by Influenza A (H1N1) pdm 09 virus. Department of Virology at Haffkine Institute has been identified as a network laboratory for the national project on surveillance of Influenza like illness under the NCDC-IDSP. Understanding the prevalence and epidemiology of influenza virus infections will not only help in control of the disease as well as aid in the development of effective vaccines.

Under this program, we receive nasopharyngeal/throat swabs from hospitals in and around Mumbai, Thane, and Raigad region. These swabs are subjected for the extraction of viral RNA and the positivity is detected using qRT-PCR.

Objectives

1. To provide epidemiology and seasonality data of influenza virus.
2. To understand the groups at high risk of severe outcomes, including hospitalization and deaths.

Result and Conclusions

From April 2020 till March 2021, we have not received nasopharyngeal/throat swabs, for influenza testing.

2. Surveillance of Mosquitoes in MMR region to assess their potential as vectors of viral infections. (Intramural Funding)

Team

- Dr. Mrunal-Ghag Sawant (Department of Zoonosis),
- Dr. Sandeepan Mukherjee (Department of Virology)

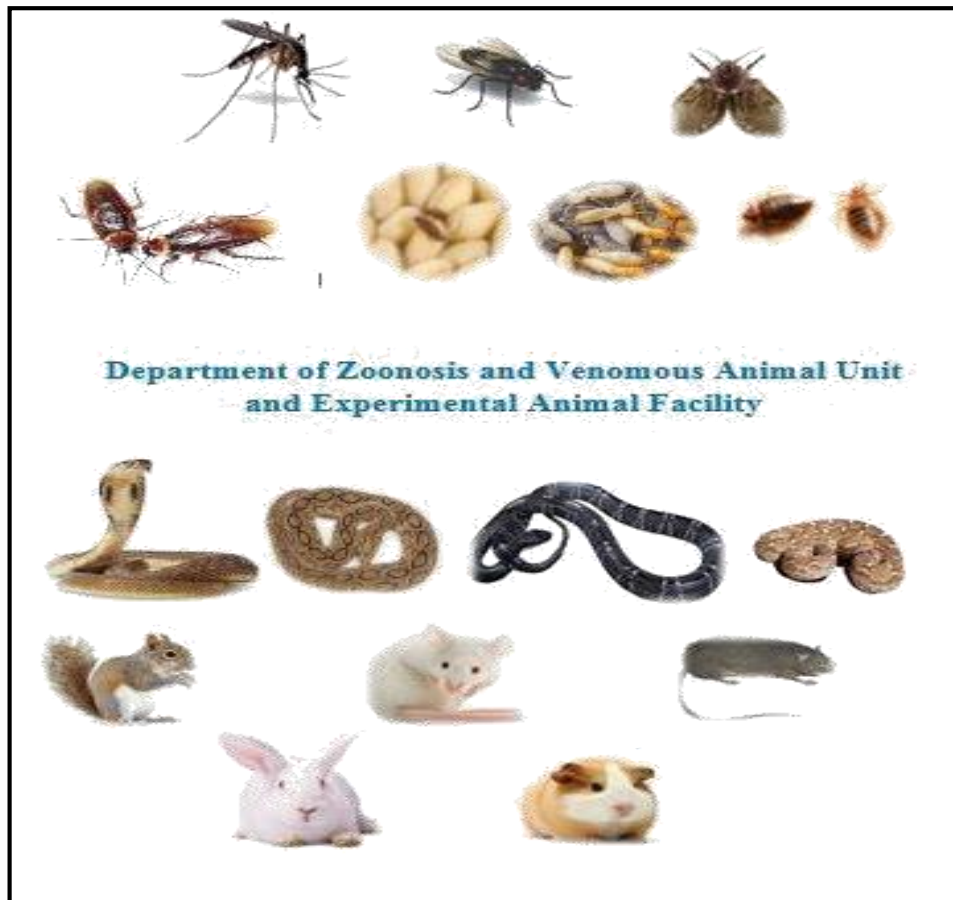
Funding Agency - Haffkine Institute

Duration - December 2021- Jan 2022

Budget – 2 Lacs

Abstract

Mosquito borne viral diseases have always caused large scale morbidities and significant mortalities in communities. The present study which is being carried out in collaboration with the Department of Zoonosis, Haffkine Institute, shall evaluate the prevalence of such viral vectors in the MMR region



Zoonosis and
Venomous Animal Unit and
Experimental Animal Facility

Zoonosis and Venomous Animal Unit and Experimental Animal Facility 2020-21 and 2021-22



Dr. Mrunal Ghag-Sawant
Head of the Department

Zoonosis

Overview

Department of Zoonosis have three different units functional under the same umbrella namely Entomology unit, Venomous animal unit and Experimental animal facility. Department is committed for training, research and testing in the field of Vector and vector borne diseases, snake and snake venom and animal disease models.

History

The present Zoonosis department was started in the year 1938 as Department of Entomology under the leadership of Dr. M. Sharif, DSc. PhD, to work mainly of entomology with plague and its transmission. Dr. P. J. Deoras, Assistant Director has succeeded after that and continued to work on plague and established venomous animal unit along with insect colonies of Public Health Importance. The history of venom/ anti-venom research and procedure for venom extraction from live venomous snakes started way back before 1920. Experimental animal facility is CPCSEA approved state of art animal facility for small laboratory rodents and functioning as centralized facility of Haffkine institute wherein various research, training and testing activities are performed.

Present state of affair

Currently department is actively engaged in Training, research and testing and besides the earlier activities new training and testing methodologies are regularly introduced with full zeal and devotion.

In research, the entomology unit is contributing to existing knowledge in Public health and Infectious zoonotic diseases with special reference to Malaria. The various projects in the department are aimed to understand- vector behavior, Vector Control, Contribution

of the genetic mutations towards insecticide resistance, Diagnosis of the disease, investigating the role of trace metals in disease pathophysiology, by doing in vitro cultivation of malaria parasite, screening of various antimalarial natural compounds is carried out development of new and improving existing vaccines. The venomous animal unit has license from state forest department to maintain various kinds of a venomous, non-venomous snakes and scorpions. The major research activity of venomous animal unit is on snake venoms to explore their therapeutic potential such as anti-cancer, anti-inflammatory potential. This unit is involved in screening of natural compounds to explore their repellent property against snakes in laboratory, is also engaged in research on anti-snake venom and anti-scorpion toxin which will facilitate in reduction of snake bite and scorpion bite fatality incidences and venomomics of snake venom proteins. One of the major roles of the department is to provide good scientific grade lyophilized venom for anti-venom producing and other research institutes.

Experimental animal facility is involved in various core areas of animal research includes standardization and validation of various animal disease models of infectious and metabolic disease, zoonotic disease such as Rabies, Japanese encephalitis, Anti-Inflammatory, Osteoarthritis, Anti-diabetes, wound healing etc.

In training, the department conducts various training programs on "Snakes and their Importance" for those who are working with public health authorities, paramedical, veterinary and medical institutes, colleges and schools, at state and national levels. "Mission to control mosquito menace" aimed at training and teaching the college students and other interested professionals to create public health awareness in the control of Mosquito and mosquito borne diseases. Animal facility conducts workshop on "Principle and practices of laboratory animal care" which encompass concepts of in vivo experiments and its applications in the field of research as well as ethical issues, welfare regulations.

In testing, the Department is a Central Insecticide Board, Ghaziabad, New Delhi approved center and is actively engaged in testing of household insecticides as per WHO guidelines, this department also provides testing facilities for identification of venom samples especially those seized by police and forest departments of India. Experimental animal facility conducts various academic animal testing activities such as the Anti-Inflammatory, Hepatotoxicity, Hyperlipidemia, Malaria, Filarial, Osteoarthritis, Atherosclerosis and Fistula in Ano etc. Apart from this department also provides rented facility for organization/ institution for their research/ breeding purpose with prior permission of Institutional IAEC committee.

Insect breeding laboratory and insecticide testing facility

The present insect breeding laboratory was established in year 1938. This laboratory has state of art breeding and rearing of laboratory insects colonies of Public Health Importance. Current insect breeding laboratory have live phase of clinically important mosquito species such as *Aedes aegypti*, *Culex quinquefasciatus*; fly species such as *Musca domestica* among flying insects. This laboratory is also breeding and rearing crawling insects, such as *Periplaneta Americana*, *Blattella germanica* and *Blatta orientalis*.

Insect rearing is performed by trained personnel with at most biosafety, occupational safety and ethical precaution.

The insectary rooms are maintained at 28°C and ~80% humidity, with a 12 hr. day and night cycle. Mosquitoes are bred in metal cages and fed with blood by using laboratory animal in order to get continues colony for testing and research purpose. All trays and buckets consisting adult insect, larvae and pupae are covered with non-chemical treated netting. If any insect escape during handling, they either be collected by using catching device or killed by using commercially available electric racket.

Research activities Insectary provides laboratory bred sterile insects for various Bio efficacy, persistency, repellence, testing against crawling & flying insects, mosquito repellence test on human skin, as per WHO guidelines.

Future Plan

1. To establish well equipped Insect breeding laboratory.
2. To establish GLP/NABL compliance testing and research laboratory.
3. Up gradation of laboratory facility for housing and testing of squirrel, bird and termite.

Support for COVID testing activities (2020-21)

The first case of COVID-19 in India, which originated from China, was reported on 30 January 2020. In March, after the lockdown was imposed, still Haffkine Institute was working as frontline supporters for government of Maharashtra for COVID-19 testing. Department of Virology took initiative in testing of COVID-19 samples. However, due to insufficient manpower in virology department, scientist and staff of department of zoonosis wholehearted participated in supporting and testing of COVID-19 samples since March 2020 onwards till date along with handling routine departmental testing.



Departmental Photograph

Venomous Animal Unit

Overview

Haffkine Institute is a one of the oldest biomedical research institute in the country. It was established in 1899 and is named after, Dr. Waldemar Mordecai Haffkine who invented plague vaccine. Since then, the Haffkine Institute has emerged as a multi-disciplinary institute engaged in training, research and testing of various aspects of infectious diseases.

In 1920 Venomous Animal Unit is India's premier unit working on snake and was established to prepare anti-venom sera against venomous snakes and scorpions and also to study- Repellency of snakes against various herbal and chemical components, Behavioral changes in serpentines, Anti-snake and anti-scorpion venoms.

The history of venom/ anti-venom research and procedure for venom extraction from live venomous snakes originated way back before 1920 by honorable Dr. Dalal. This facility has license from state forest department to maintain various kinds of a venomous, non-venomous snakes and scorpions in captivity for 90 days.



Photo Courtesy: Digital Library of University of South Carolina

The old snake housing facility was constructed way back in year 1960. However as per the current international norms serpentarium is upgraded to house more than 100 snakes. This advance facility have environmental parameter control systems. Snakes are hunted from permitted forest divisions and brought to serpentarium. Then snakes undergo period of quarantine, during which complete health checkup is performed. Snakes are then introduced in stock for venom milking purpose. Snakes are fed with healthy laboratory bred mice or rat. Snake venom is extracted from different types of venomous snakes manually using head catch method with minimal stress to snakes. Extraction is performed by trained personnel at regular intervals under the supervision of veterinarian and medical doctors with at most biosafety, animal safety, occupational safety and ethical precaution.

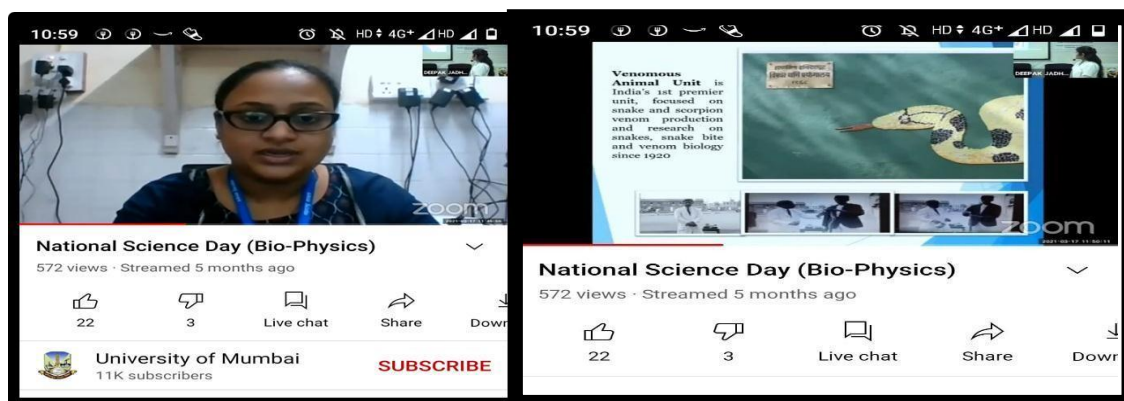
This extracted venom is stored in the form of lyophilized powder until its requirement for production of anti- snake venom and for various aspects of research and education. Snakes are handed over to forest department after the holding period of 90 days to release back in natural environment.

Future Plan

- To establish western zone venom referral center
- To establish NABL compliance testing and research laboratory

Events & Celebrations: (2020-21)

On 19 March 2021, Venomous Animal Unit, Department of Zoonosis celebrated online National Science Day in collaboration with Bio-physics department, University of Mumbai.



National Science Day Celebration



Department Photograph

Experimental Animal Facility

Overview

The Experimental animal facility is available to boost the teaching, training and research facilities and to meet the growing demand for high quality laboratory animals in emergent field of Laboratory animal science. Qualified veterinarians and technical personnel are always at hand to help carry out research and keep it in accordance with the standards established by the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA). **Animal care** the laboratory houses rats, mice and rabbits. Each species of animals is maintained in individual rooms to avoid disease transmission and inter-species conflicts. All efforts are made to maintain the animals under controlled environmental conditions [Temperature (22- 26°C), Relative Humidity (60 ± 10 %), 12 hr alternate light and dark cycle] with 100 % fresh air exchange in animal rooms and uninterrupted power and water supply. The support staffs ensure that every part of animal care including feeding, watering, restraining, cage cleaning, record keeping and ordering of animals, feeds, bedding materials and equipment from outside sources are monitored. The animals themselves are isolated from human habitation and guarded from dust, smoke, noise, wild rodents, insects and birds-in fact anything that would disturb their habitat. A high degree of hygienic conditions (macro- and micro-environment) around the animals are maintained as per the CPCSEA guidelines.

Animal ethics The Animal House is registered with the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), Ministry of Environment and Forests, Govt. of India (Reg. No) and has an established Institutional Animal Ethics Committee (IAEC) that advises the students, teachers/researchers on facilities, policies and practices concerning the care and use of animals.

Veterinary care Periodic health monitoring of the animals is carried out to ascertain the health status of the animals. Veterinary care is crucial to keep the animals content and healthy. The veterinarian keeps them under daily observation and monitors any behavioral changes or signs of illness. The veterinarian supervises their diet and sanitation and contributes to the formulation of appropriate policies and procedures for ancillary aspects of veterinary care.

Various core areas of animal research include standardization and validation of various animal disease models of infectious and metabolic disease, zoonotic disease such as Rabies, Japanese encephalitis, Anti-Inflammatory, Osteoarthritis, Anti-diabetes, wound healing etc.

Visitors to the Department (2020-21)

On 12th March 2021 Dr. Krishanu Ray from Tata Institute of Fundamental Research (TIFR), Department of Biological Science visited to Experimental Animal facility.

Dr. Mrunal Ghag Sawant



Department Photograph

Core facilities

1. Insect breeding laboratory and insecticide testing facility



Mosquito rearing facility



Mosquito rearing facility



Adult Mosquito collection for Testing



Peet – Grady Chamber for Insecticide testing

2. Serpentarium (Venomous animal unit)



Complete view of snake housing



Provision of hideouts for snakes



Snake Venom extraction



Safety provision for handling venom in laboratory

3. Experimental Animal Facility



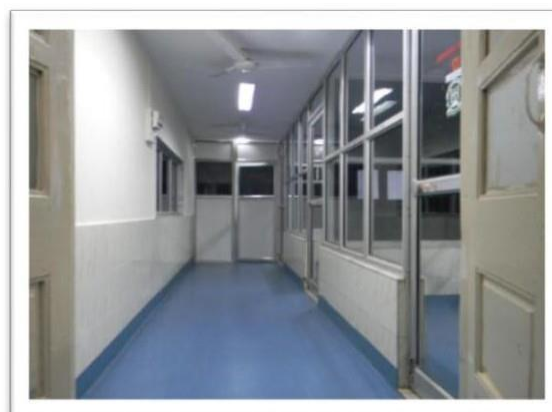
Experimental Animal Facility



Autoclaving Room



Individual Ventilated Caging System



Clean Corridor

1. Bioefficacy and Repellency of incense cones incorporated with mint leaves powder and orange peel powder and Repellency test of mint leaves oil and orange peel oil in cream base against *Aedes aegypti* mosquitoes.

Team

Investigators

- Dr. Mrunal Ghag Sawant,
- Mrs. Trupti Satvekar
- Mr. Pradeep Jadhav

Project Team

- Mr. Vishal Sanjay Temkar,
- Dr. Rupali Tasgaonkar Yadavrao,
Tasgaonkar Institute of Pharmacy

Funding Agency - Haffkine Institute

Duration - 09/09/2019 -20/03/2020

Abstract

Mosquito repellent are available in various forms in the market however sometimes it is observed that mosquitoes develop resistance against repellents. Herbal repellents are one of the safe and good alternative for repellents. Objective of the present study was To evaluate Bioefficacy of incense cones incorporated with mint leaves powder and Orange Peel powder and evaluate the Mosquito Repellent activity of test samples (mint leaves oil and orange peel oil in cream base) against mosquitoes. We conducted Bio efficacy study of mint leaves cone was carried out in Pet-Greedy chamber and knockdown of the mosquitoes at the interval of 5 mins was recorded up to 60 min and mortality was observed at end of 24 hours. In present repellency study test sample in the form of Mint oil and orange oil in cream was applied on whatman paper and checked for its repellence against mosquito.

Results

Based on the Bioefficacy study, it was observed that both mint leaves cone and orange peel cones shows 95% knockdown within 50 minutes and 100% mortality at the end of 24 hours for *Aedes aegypti* mosquitoes whereas in repellence study it was observed that mint leaves oil in cream base shows 90% repellence, Orange peel oil in cream base shows 86% repellence. It was also observed that whereas combination of mint leaves oil and orange peel oil in cream base shows 92% repellence against *Aedes aegypti* mosquitoes.

2. Comparative study of green synthesized zinc nanoparticles and methanolic extract of *cestrum nocturnum* and *ervatamia coronaria* on larvicidal potential, histopathological alterations and behavioral changes against *Aedes aegypti*

Team

- Dr. Mrunal Ghag Sawant (PI)
- Ms. Nandini Darji (Strip Student)

Duration: 01/01/2021 - 30/06/2021

Budget : 25000/-

Abstract

Aim and Objective: This study aimed to investigate the Impact of Green Synthesized Zinc Oxide Nanoparticles and Methanolic Extract of *Cestrum nocturnum* and *Ervatamia coronaria* on the Larvicide Potential, Behaviour, Morphology and Histopathological alterations at the early fourth instars of dengue vector, *Aedes aegypti*. Subsequently comparison was made between the methanolic extracts and Green synthesized zinc nanoparticles of the Plant samples.

Methods: Methanolic Extraction of plant samples were done in accordance with the Soxhlet method. Simple and eco-friendly method for the synthesis of zinc nanoparticles using *Cestrum nocturnum* and *Ervatamia coronaria* leaf extract was done. Larvae of *Aedes aegypti* in instar III to the beginning of instar IV were treated with various concentrations of the sample extracts and LC50 and LC 90 was calculated. The negative control group did not show any treatment, whereas the positive control group exhibit 100% percent mortality. Dead larvae were collected after 24 hour of treatment for the examination of morphological and histological changes.

Results: Analysis of both the extract using GC-MS revealed the presence of key phytochemical compounds. The n-hexadecanoic acid and Phytol was found in both the plant samples.

Characterization was done for both the samples by visual observation, UV visible spectroscopy and Dynamic light scattering (DLS) which confirmed the presence of Zinc Oxide Nanoparticles. The investigations clearly indicated the larvicidal efficiency of all the extracts. The most considerable amount of mortality was noticed in the *C. nocturnum* synthesized ZnO NP's with LC50 58.3ppm at 48 hours when compared to other Extracts. Behavioral observations of the treated larvae revealed decreased activity as compared to control indicating the probable effect of the extracts on the neuromuscular system of larvae. Microscopic observations of the dead larvae showed shrunken body size and dark pigmentation.

Conclusion

Our results suggest the probable use of Green synthesized zinc nanoparticles of *Cestrum nocturnum* and *Ervatamia coronaria* as an efficient and eco-friendly larvicide against *Aedes Aegypti* compared to the



Methanolic Extracts of the same. Further investigations are needed to identify the bioactive constituent and as certain its effectiveness in the field conditions.

Larvicidal Assay



TLC Ervatamia coronaria



TLC Cestrum nocturnum

3. Standardization of procedure for extraction of toad venom

Team

- Dr. Mrunal Ghag Sawant (Head of Department)

Supporting Staff

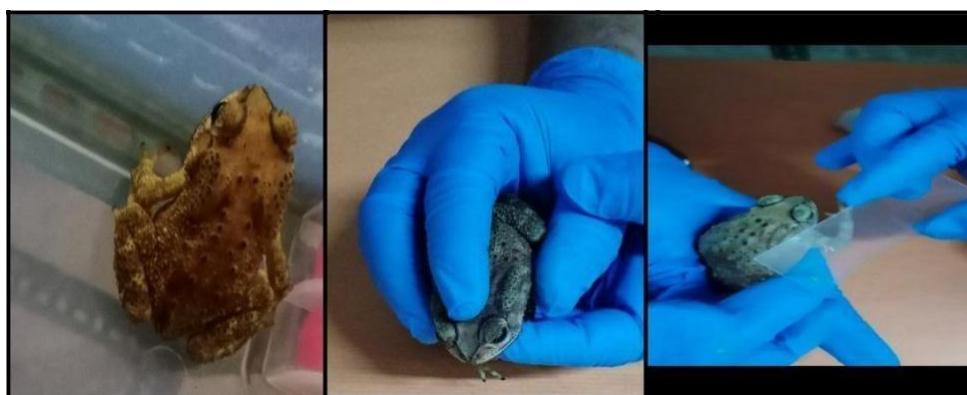
- Mr. Pradeep Jadhav,
- Mr. Sanjay Mane,
- Mr. Rohan Nimbalkar,
- Mr. Ashirwad Ravrane,
- Mr. Suhas Pawar,
- Mr. Vagesh Walhekar

Funding Agency - Departmental project

Duration - 08/01/2021 - 10/04/2021

Abstract

The toad venom has made significant contributions to human health as a creature. There are 34 genera and 410 species of toads all over the world. Toads can be harmful, causing muscle weakness, a high heart rate, and vomiting. Toad venom, toad skin, and toad clothing are currently the only components of toads that can be used directly as medication. The toad venom is basically the same; however, the difference in the concentration of the components is large. Thus, the differences in pharmacological functions and clinical applications of the varied toad medicines are very distinct. Toad Venom is gaining popularity around the world. In light of this, a team of the venomous animal unit developed and successfully standardized a venom extraction and Lyophilization technique for toad venom.



Procedure for extraction of toad venom

1. In vitro and In vivo Activity of Phospholipase A₂ enzyme against Plasmodium sp.

Team

- Dr. Mrunal Ghag Sawant (PI)
- Ms. Sheetal S. Shetty (M.Sc. Student)

Funding Agency - Haffkine Institute (M.sc Project)

Duration - 22/03/2021-21/03/2024

Budget - 300000/-

Approved BY - IAEC/IBSC/ Reviewed and approved by External Expert

Abstract

Malaria is a parasitic disease with vector transmission involving a diversity of parasites in different ecological environments. In 2018, the World Health Organization (WHO) reported 228 million cases of malaria, with an estimated 405,000 deaths; children under the age of 5 represent the most vulnerable group for this endemic disease. Available drugs for the treatment of malaria are also expensive, have side effects and/or there may be some drug resistance, which has encouraged the development of new drugs. Phospholipase A₂ is an enzyme that catalyses the hydrolysis in the sn-2 position of phospholipids, triggering the release of fatty acids and lysophospholipids. PLA₂s various sources have reported antitumor potential, antiviral and antiparasitic activity which makes this group of proteins promising targets of study. The aim of the study is to evaluate the *in vitro* and *in vivo* activity of Phospholipase A₂ enzyme against *Plasmodium sp.* The cytotoxic activity of the enzyme in different concentrations will be tested on Peripheral Blood Mononuclear Cells (PBMC). The 50% cytotoxic dose will be calculated by linear regression. Indirect hemolysis will be evaluated following the method that uses agarose gel-erythrocytes-egg yolk along with red blood cells in suspension. The Minimum Indirect Hemolytic Dose (MIHD) will be calculated. The *in vitro* assays will be done in a 96-well microplate with RPMI 1640 medium with *P. falciparum* cultures. The activity will be tested by SYBR Green I test and the fluorescence will be measured using spectrophotometer with an excitation of 485nm and an emission of 590nm. Enzyme concentrations showing efficacy above 60% will be assessed for their toxicity in Swiss Albino mice. The mice will be observed for any behavioral changes as per the Standard Toxicity Study Guideline, OECD. The *in vivo* antimalarial assays will be done by a four-day suppression test, followed by *in vivo* antimalarial activity. The results will be presented as mean $\pm$ S.E.M. of three replicates and experimental differences between means will be determined by analysis of variance followed by Dunnett's test for intragroup comparisons. Significance will be set up at $p < 0.05$.

2. Long-term *In vitro* Cultivation of Erythrocytic stage of *Plasmodium berghei*.

Team

- Dr. Mrunal Ghag Sawant (PI)
- Mrs. Trupti Satvekar (Co-PI)
- Ms. Neha Desale (Strip Student)

Funding Agency - Haffkine Institute (Strip Project)

Duration - 12/11/2021 - 11/05/2022

Budget - 25000/-

Approved BY - IAEC/IBSC

Abstract

The first successful cultivation of *Plasmodium berghei* was done by Trager & Jensen, 1976 by using candle jar method, but it could be maintained only up to 45 days. In further years, attempt to maintain the culture for long-term was made but it was successful for only up to 2 weeks. This projects aims towards modifying the previous protocols and attempting to cultivate and maintain *Plasmodium berghei* cultures for a longer period of time. For this, RPMI media 1640 supplemented with L-glutamine, HEPES, Albumax II and Glucose will be used as the culture media. The culture will be maintained in a CO₂ Incubator and will be observed daily by smear preparation under 100X. We expect that the modified protocol that has the modern system and method will prove useful for not only maintenance but future research studies too.

3. Monitoring and detection of mosquito borne viruses and their identification in and around Mumbai.

Team

- Dr. Mrunal Ghag Sawant (PI)
- Mr. Pradeep Jadhav (Co-PI)
- Ms. Mayurakshi Thakur (Strip Student)

Funding Agency - Haffkine Institute

Duration - 01/01/2022 - 01/06/2022

Budget - 25000/-

Approved BY - IBSC

Abstract

Mosquito surveillance is conducted as routine analysis towards the concern of public health. Any mosquito control programme will be effective if proper and regular surveillance of both larval and adult mosquito populations has been conducted over a period of time. The aim is to monitor the changes in the mosquito population, identify the species and perform quantitative analysis for the dengue virus, considering the recent outbreak was of dengue. Mosquito-borne infections continue to be a major source of morbidity and mortality in tropical areas. Despite improvements in malaria management, malaria-related morbidity remains high, while arboviruses- most notably dengue fever are responsible for an increasing burden of disease, even in middle-income nations where malaria has been nearly eradicated. Dengue virus is an important arboviral infection that causes infectious disease. When it comes to dengue fever, prevention is always the best cause due to severity of the condition. Effective vector control methods are essential for dengue prevention and management. To estimate the prevalence of viral pathogen i.e. dengue virus in mosquitoes, Quantitative Reverse Transcriptase Polymerase Chain Reaction (qRT-PCR) is used to examine small amount of viral RNA obtained from mosquitoes. This use of RT-PCR as regular laboratory procedure offers a quick alternative for detecting viral RNA in samples collected in field. To check for presence of the dengue virus, first collection and identification of adult mosquitoes, pooling, RNA extraction and qRT- PCR to be performed.

4. Monitoring of insecticide resistance and genetic diversity in mosquito disease vector.

Team

- Dr. Mrunal Ghag Sawant (PI)
- Mr. Pradeep Jadhav (Co-PI)
- Ms. Bhagyeshri Gaikwad (Strip Student)

Funding Agency - Haffkine Institute

Duration - 01/01/2022 - 01/06/2022

Budget - 25000/-

Abstract

Vector-borne disease control relies on effective vector surveillance. Insecticide resistance is an essential part of entomological surveillance. Mosquitoes of the *Aedes* genus are the primary vector of worldwide disease viruses including Dengue DEN, CHIKV, Rift valley fever, Yellow fever virus and ZIK virus vectors, with a billion of people living in endemic countries. The absence of anti-viral drugs relevant to mosquito disease vectors ultimately leads to the use of chemical insecticides which are the most effective in mosquito vector control. Taking this into consideration, the rapid emergence of insecticide resistance in mosquitoes could give major challenges for arboviral-borne disease control. In this research study, the insecticide resistance and susceptibility level mechanisms will be monitored from various places/wards of Mumbai city. As the generations and seasons change, genetic variation in mosquito vector also takes place. Due to this, regular assessments of insecticide resistance should be monitored and performed on exposed population to optimize local integrated mosquito management strategies. Therefore, the utilization of effective and safe for human's insecticides against adults as well as the larval population of mosquito vectors is the most efficient method to rapidly reduce the transmission of various mosquito vector viruses. Here, we will use pyrethroids based insecticides in which the determination of survivability and resistance activity for both adult and cultured larvae mosquitoes will be tested using guidelines of the Centre for Disease Control and Prevention (CDC) by utilizing Bottle Bioassay method. This bioassay checks the resistance mechanism or maximum mortality rate of mosquitoes just by comparing exposure and diagnostic time duration with the actual time. This study also investigates that the various mutations occurred in the Voltage-gated Sodium Channel (VGSC) conferring pyrethroid resistance against mosquito vectors. We will also study molecular genotyping sequencing of those occurred mutations that will be performed by DNA extraction followed by using Polymerase Chain Reaction (PCR) assay and sequencing method. Identification and determination of insecticide resistance should be routinely and regularly performed for the developing effective mosquito control programs in Mumbai.

Events and Celebrations (calendar wise) (2021-22)

1. On 6th July 2021, Department of Zoonosis celebrated online **World Zoonosis Day** organized by Zoonosis department, NCDC-Department of Virology and Department of Training.
2. On 20th August 2021, Department of Zoonosis celebrated online **World Mosquito Day**.
On the occasion of **World Mosquito Day** “Lecture and Slogan Competition” organized by Haffkine Institute.
3. On 24th, 25th March 2022, Department of zoonosis /VAU organized “Introduction to covert Existence of snakes & Mission to control Mosquito Menace” training programme.
4. On 39th March 2022, Department of Zoonosis organized “Mission to control Mosquito Menace” training programme.



Department Photograph

Departmental activity

Bio-Safety Cabinet (BSC-2)



Cooling Centrifuge



Dissection Microscope



Fluorescence Microscope



Inverted Microscope



Lyophilization Machine



Clinical Check-up of snake



Peet-Grady Chamber



Crawling Insects Rearing Facility



Testing of mosquito repellent cream on human beings



Restraining of Snakes for venom Extraction



Provisions of hideouts for snake



Supporting Departments

Dispensary

2020-21 and 2021-22



Dr. Shashikant Vaidya
Head of the Department

Overview

- Dispensary provides comprehensive primary Health care for acute illness like U.R.T.I., UTI, Gastroenteritis, Gastritis, Hypotension, Fever, Injuries etc, and Chronic illness like Hypertension, Diabetes, Dyslipidemia, Anemia , Hypothyroidism, Chronic joint pain etc . Antenatal care is also provided to pregnant employees. Medical officers educate the patient about future complications of their illness by counseling and creating awareness.
- Dispensary emphasizes on Preventive Health care by providing Pre-exposure prophylaxis vaccination facility to its employees and students for Hepatitis-B, Rabies, Tetanus, and Influenza. Dispensary has conducted Medical Checkup for animal care staff.
- OPD treatment and consultation facility is provided by Medical officers for PWD staff, HBPCL employees whenever required.
- Dispensary provides first aid facility to all departments.
- Medical Officers were actively involved in Data Entry work related to Novel Corona Virus (COVID-19) testing.



Department Photograph

Library

2020-21 and 2021-22



Mrs. Sarita Ajit Wadekar
Librarian

Overview

The aim and objective of the Haffkine Institute Library is to collect, organize, search and retrieve information in the areas of prime activities of the institute i.e. Research in Biomedical and allied sciences with a special reference to the communicable diseases.

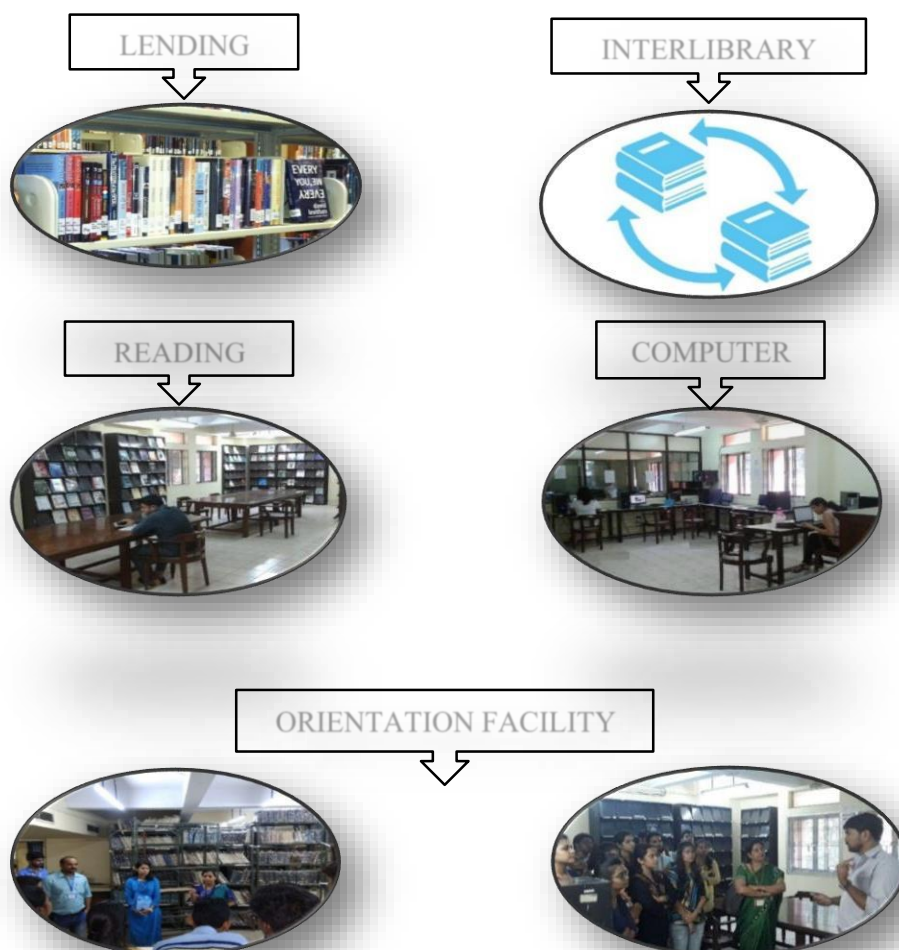
This year library continued to provide online scientific search and retrieval facilities to the staff, researchers and students. Users mainly consisted of Scientific Staff, Research Fellows and the students enrolled for the various programmes of the institute. The library also provided reference service by Telephone, Email, Post, Courier, etc. to the distant users who could not come to the library.

The library made available different research and scientific publications from other libraries to the scientists and students of the Haffkine Institute on the basis of Inter Library Cooperation. Similarly, publication available in our library were made available to other libraries in the current year. The library regularly imparted induction and orientation training to outside visitors and new students of the institute on library usage and how to conduct the literature search effectively. In the year 2020-21 the library departmental staff Mr. Shashank Sarang contributed to the Covid-19 testing activities in the Institute.

Library Collection

DESCRIPTION	Total
Books	10908
Bound Volumes of Journals	27603
Theses	511

LIBRARY FACILITY



THE LIBRARY COMMITTEE

The Library Committee Members meet regularly to discuss the matters associated with the library.

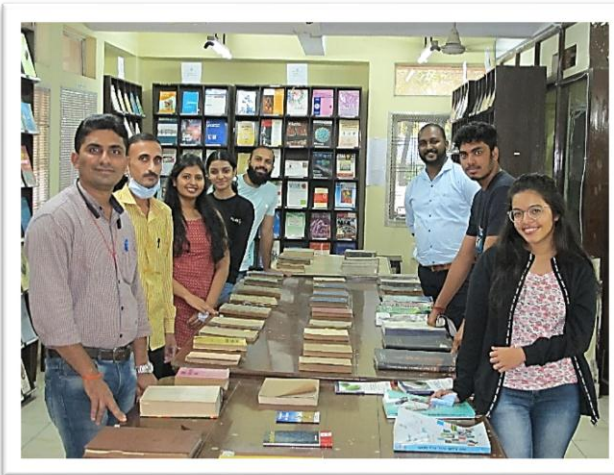
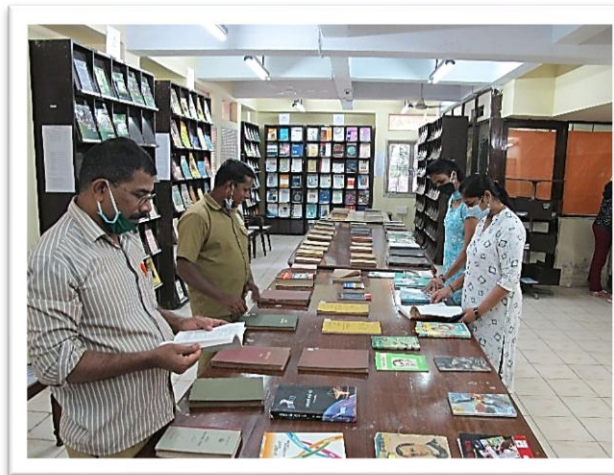
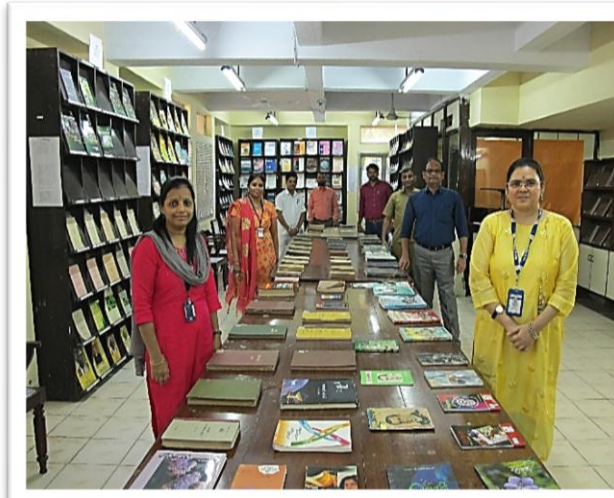
Sr. No	Name of Committee Member	Designation
1	Dr. Sandeepan Mukherjee	Chairman
2	Dr. Ashish Asrondkar	Member
3	Ms. Swati Mumbarkar	Member
5	Account Officer (Haffkine Institute)	Member
6	Ms. Sarita Wadekar	Member Secretary



Department Photograph

BOOK EXHIBITION (2021-22)

The Haffkine Institute Library organized a Book Exhibition to commemorate the “**Marathi Bhasha Samvardhan Pandharwada 2022 on 27th January, 2022**”.



Radiation Biology Unit

2020-21 and 2021-22



Dr. Anuya Rege
Senior Scientific Officer



Mr. Manoj K. Patil
Scientific Officer & Radiological Safety Officer

Overview

This facility was sponsored by Department of Science and Technology (DST). The main aim and objective of the Radiation Biology Unit is to provide a safe and secure laboratory for handling and storage of radio-isotopes and to conduct experiments related to radio-isotopes/radio-labelling, as per the guidelines established by the Atomic Energy Regulatory Board (AERB), Gov. of India.

Furthermore, the Radiation Biology Unit is approved as Type II laboratory for handling low energy Beta (β) emitting sources such as Tritium (H^3), Carbon (C^{14}), Phosphorous (P^{31}) and Sulphur (S^{35}). The facility can be useful for work related to radioactive organic and bio-organic molecules, radio-labelled plant extracts etc., which can be achieved by collaborating with the Board of Radiation and Isotope Technology (BRIT), to make radio-labelled compounds.

Instruments available in the Facility

- 1) Liquid Scintillation Counter
- 2) Phosphor Imager
- 3) Centrifuge
- 4) Fume Hood
- 5) Radiation Survey Meter
- 6) Cryostat Microtome



Liquid Scintillation Counter



Phosphor Imager



Fume Hood

Training Department

2020-21 and 2021-22



Dr. Anuya Rege

Head, Department of Training
(26-11-2015 to 24-11-2020)



Dr. Vrushali Patil

In-charge, Department of Training
(25-11-2020 to Till Date)

Overview

Haffkine Institute has multi-disciplinary approached and affianced in Training, Research and Testing of various aspects of communicable diseases. The Institute serves as a foremost leading teaching institution in the field of biomedical sciences.

Haffkine Institute has been affiliated and recognized by the University of Mumbai for M.Sc. (by Research) and Ph.D. Degree courses in Applied Biology, Microbiology and Chemistry. It has also been affiliated to Maharashtra University of Health Sciences (MUHS), Nashik for Ph.D. degree course in Applied Medical Biology.

Haffkine Institute also offers a research platform through Short Term Research Internship Programme (STRIP) to the students who are pursuing their master degrees under the recognized universities. Training department is also actively engaged in coordination of various training programme in different batches.

Besides, Department of Training also Coordinated and conducted interviews for M.Sc. (by Research) and Ph.D. [Applied Biology, Microbiology and Chemistry] for the new candidates during the year 2020-21 and 2021-22.

- Policy/Guideline of Haffkine Institute has been finalized by Governing Council for M Sc & Ph. D on 17 March 2021.

Furthermore, Training department also organizes visit to Haffkine Institute's Museum for school and college students registered under various Boards/ Universities, Medical and Nursing students of various Hospitals, Foreign tourists and general public of the society and staff of the Haffkine Institute /HBPCL.

Training activity

1. Analytical Training for Instrumentation

Analytical Training for Instrumentation (ATI) is conducted by Department of Chemotherapy. This course aims to equip participants with the analytical and interpretative skills critical for working in the laboratory. These skills will be acquired through experimental methods with particular emphasis on safety, essential calibration and fundamental method validation, chromatography and spectroscopy instrumentation as well as data handling, analysis and reporting. The skills and knowledge learnt will reinforce chemistry theories and their applications in the workplace. Upon successful completion of this course, participants will be able to carry out essential analytical work in the laboratory independently.

2. Hands on Training in Techniques in Virology and Immunology

Department of Virology conducts the course entitled 'Hands on Training in Techniques in Virology' (HoTT Virology) annually. This course is open for undergraduate and post graduate students in various fields of biological sciences. It aims to impart hands-on skills to these students required for research in Virology. This program is conducted during mid-May to mid-July every year. The program is conducted in different batches, each batch running for five days. It covers lectures on topics such as Biosafety, Life cycle of DNA/RNA/Retroviruses, Differential diagnosis of viral infections to name a few. It also includes hands-on sessions on Haemagglutination/inhibition, Chick embryo inoculation, ELISA, PCR, Animal tissue culture etc.

3. Introduction to Covert Existence of Snakes

Introduction to Covert Existence of Snakes (ICES), a one of a kind of Snake Workshop designed to upgrade the knowledge on Biology & conservation of snakes, snake bite, anti-snake venom and post bite measures and to create awareness about snakes. A pioneering initiative by the Haffkine institute is aimed at all those people who have taken the efforts to understand and learn about their co-existing reptiles. Be it snake rescuers, students, enthusiasts who would like to improve their knowledge or others who want to learn right and ethical methods of handling them, dealing with accidental bites so this comprehensive snake workshop is an open door to learning about reptiles. This workshop encompasses awareness about Snakes, Snake conservation and Rescue techniques, Snake bite and Anti-snake venom Production, Importance of venom in Biomedical Research and Maintenance of Snake in Captive. This workshop is of two days duration for a batch of 10 students and conducted by Venomous Animal Unit of Zoonosis department.

4. Principle and Practices of Laboratory Animal Care

The course is designed to impart theoretical knowledge and provide practical exposure to the participants in laboratory animal science and management as per the requirements for persons carrying out and responsible for directing animal experiments. The syllabus includes importance of animals in biomedical research, CPCSEA and Three R's of experiments, Identification of strains, IAEC Protocol Writing, Ethical Evaluation and Severity assessment, Euthanasia, Anesthesia, Necropsy and Histopathology techniques and Animal Experimentation techniques (Hands on). The training programme includes lectures by experts and practical hands on sessions. This workshop is of two days duration for a batch of 15-20 students and is conducted by Venomous Animal Unit of Zoonosis department. Students who are studying/ have passed their B.Sc. / B. Tech. / M.Sc. / M. Tech degrees in Microbiology/Biochemistry/ Biotechnology/ Zoology/ Botany/ Life Sciences from any Recognized University and People already in service, working in the above areas, are eligible for this course.

5. Short Term Research Internship Program (STRIP)

Haffkine Institute provides a research platform through Short Term Research Internship Program (STRIP) to the students who are pursuing their master degrees under the recognized universities. The selected candidates work on Research projects for 4-6 months duration as their academic need or for the partial fulfilment of their B. Tech, M. Tech, B.E. or M. Sc. degrees. The detailed advertisement & application form are usually displayed on the institutional website. After last date of submission, an orientation is conducted which starts with a MCQ type test followed by actual interaction with the mentors. The selection of candidates is carried out on the basis of merit and they are placed in different institutional departments. The candidates get opportunity to work on research projects encompassing various multi-disciplinary areas of Biological and Chemical Sciences. Upon completion of their project, the students are usually asked to present their work in the form of Power Point Presentations (PPT) and are evaluated. They are also asked to submit their work in the form of thesis. On successful completion of project the students are awarded with duly signed certificate by the mentor & the Hon. Director.

With the co-ordination of Training department, we successfully completed STRIP 2021 batch.

List of STRIP Interns batch as below: (2020-21)

Sr. No	Name of Students	Name of Mentor	Department
1	Shashanka Sahu	Dr. Shashikant Vaidya	Clinical Pathology
2	Vidya Kumbar	Dr. Usha Padmanabhan	Cell Biology
3	Meenakshi Powar	Dr. Usha Padmanabhan	Biochemistry
4	Nandini Darji	Dr. Mrunal Ghag Sawant	Zoonosis
5	Afshan Rizvi	Dr. Vrushali Patil	Chemotherapy
6	Soudarya Prithweeraj	Dr. Amruta Naik	Biochemistry
7	Shruti Karkare	Dr. Sandeepan Mukherjee	Virology
8	Cleon D'souza	Mr. Pavankumar Todkar	Virology

6. Testing of Alcoholic Beverages

Workshop on “Testing of Alcoholic Beverages” (TAB) is a two days training programme conducted every year during April to June in Chemical Testing Unit of Haffkine Institute. This programme gives students exposure to how Alcoholic Beverages are tested using instruments like Alcoholiser, Gas Chromatography, Hydrometer, etc. Also it gives information to students regarding use of alcohol in varied fields. Students find this training programme interesting and informative. The general rating received for TAB is Very Good to Excellent. The general capacity for each batch is up to 10 students per batch.

Training Programme for the year 2020-21:

Training department initiated and supported following new activities:

List of New Training programme: (2020-21)

Sr.No	Department	Training Course
1	Biochemistry	Advance Research Techniques (ART)
2	Cell Biology	Advance Research Techniques (ART)
3	Chemotherapy	Advance Training on HPLC
4		Hands on Training –GCMS
5	Clinical Pathology	Training in Techniques of Microbiology
6		Training in Basic Techniques of Mycobacteriology
7		Training in Infection Control & prevention in Healthcare Setting
8	Toxicology	Zebra Fish as evolving model for research

Training Programme for the year 2021-22

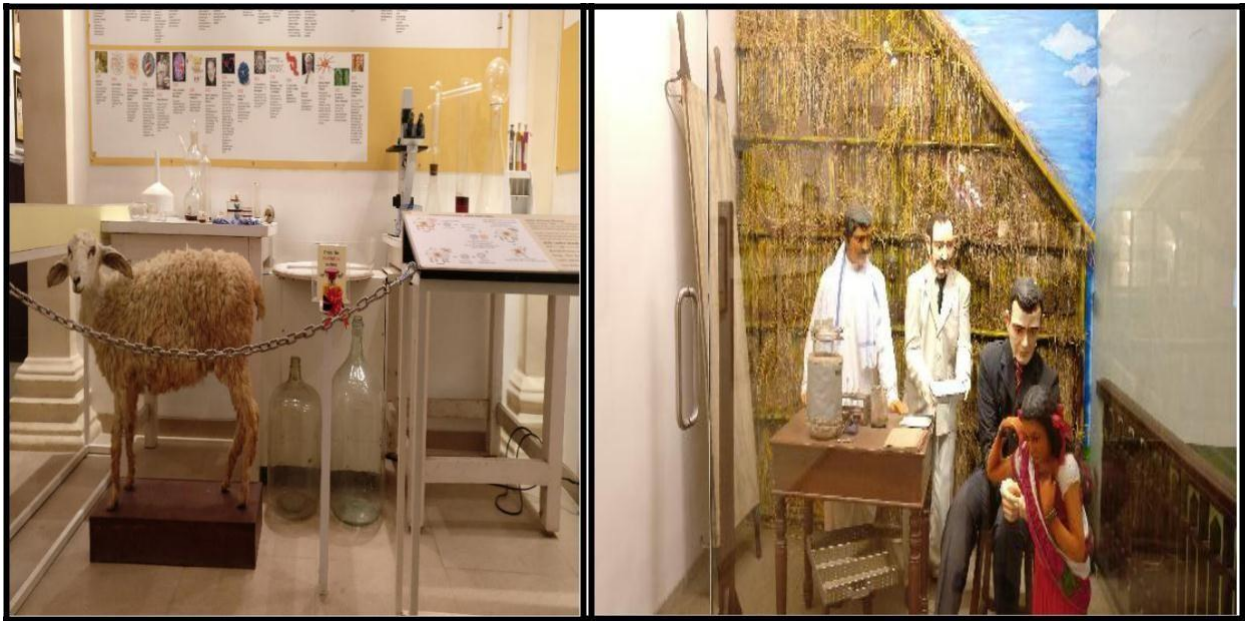
Sr. No	Name of Department (Alphabetical Order)	Name of Training Programme	Duration	No. of Students* *	Revenue Generated (Rs.) **
1	Chemical Testing Unit	Testing of Alcoholic Beverages	2 Days	Nil	Nil
2	Chemotherapy	Analytical Training for Instrumentation	3 Days	Nil	Nil
		30 Days Training Programme	30 Days	20	1,00,000
		45 Days Training Programme	45 Days	02	15,000
		90 Days Training Programme	90 Days	09	1,35,000
		One Month Advanced Training on HPLC	1 Month	03	30,000
3	Training	Short Term Research Internship Programme (STRIP)	4-6 Months	22	5,50,000
4	Virology	Hands on Training in Techniques in Virology	5 Days	Nil	Nil
5	Zoonosis	Introduction to Covert Existence of Snakes	2 Days	Nil	Nil
		Principle & Practices of Laboratory Animal Care	2 Days	Nil	Nil
	Total Revenue (Rs.)				8,30,000

** Due to Covid -19 Pandemic many training programs was not conducted during the year 2021-22.

List of STRIP-2021-22 (Batch-1 & 2)

Sr. No.	Student Name	Department	Name of Mentor	Title
1	Tejaswini Anurag Pandey	Virology	Dr. Sandeepan Mukherjee	This is to certify that the research work presented in this thesis titled "Assessment of differential gene expression in human cell line infected with influenza A (pH1N1) virus.
2	Atish Shantaram Dongarkar	Chemical Testing Unit	Mrs. Suvarna Pachpore	To Determine Nutraceutical Potential and Antimicrobial Potential of Powder of Dried <i>Hibiscus rosa-sinensis</i> L. Flowers
3	Pranali Jitendra Raut	Chemotherapy	Dr. Ashish Asrondkar	<i>In-Silico</i> Studies on Activity of Apigenin and Genistein Derivatives Against Rabies Virus.
4	Aaditi Ashish Rautmare	Clinical Pathology	Dr. Shashikant Vaidya	Prevalence and Characterization of Methicillin Resistant <i>Staphylococcus Aureus</i> (MRSA) on touch surfaces in Mumbai Suburban Railways".
5	Shruti Govind Mahajan	Cell Biology	Dr. Usha Padmanabhan	To study the effect of β -estradiol on the development of chick embryo and to correlate it's genotypic gender and phenotypic gender
6	Mohammed Tabrez Banegar	Virology	Dr. Sandeepan Mukherjee	Assessment of differential gene expression in human cell line infected with influenza A (pH3N2) virus.
7	Shubham Mohan Kalaskar	Toxicology	Dr. Mrunal Ghag-Sawant	Toxicity and Anti-Inflammatory Activity of 2-NITROTHIAZOLE
8	Neha Ravindra Desale	Zoonosis	Dr. Mrunal Ghag-Sawant	Plasmodium berghei in Vitro Culture: A New Approach
9	Ms. Sakshi Ajay Gupta	Bacteriology	Mrs. Jayashree More	Isolation and Identification of Hydrocarbon Biodegrading Bacteria from Soil Samples.
10	Ms. Disha Sanjay Ekawade	Virology	Dr. Sandeepan Mukherjee	Assessment of <i>In vitro</i> Immunomodulatory activity of select Antiviral agents

11	Ms. Ragini Prakash Mahajan	Clinical Pathology	Dr. Shashikant Vaidya	Investigation of Anti-TB activity of crude plant extract on mammalian cells
12	Mr. Avdhut Vishwanathrao Pawar	Biochemistry	Dr. Amruta Naik	Discontinued
13	Ms. Susan Samuel Martin	Bacteriology	Dr. Anuya Rege	Determination of Antimicrobial and Anti-Biofilm activities of Alum and its Bhasma-An <i>in vitro</i> comparative study.
14	Ms. Snehal Shashikant Annadate	Cell Biology	Dr. Usha Padmanabhan	Isolation of Monoclonal Antibodies from Rabies infected Horse Serum
15	Mr. Abhishekh Rajesh Tiwari	Virology	Dr. Sandeepan Mukherjee	Assessment of Immunological response of Human Monocyte cells on exposure to Influenza Vaccine <i>in vitro</i>
16	Ms. Sarah Musaddik Khatkhatay	Clinical Pathology	Dr. Shashikant Vaidya	Gene expression studies of Influenza Virus Infected host cells.
17	Ms. Mayurakshi Anukunj Thakur	Zoonosis	Dr. Mrunal Ghag-Sawant	Microbiological Surveillance of Mosquitos in and around Mumbai
18	Ms. Sarah Asif Shaikh	Chemotherapy	Dr. Vrushali Patil	Kinetics and <i>In Silico</i> studies on Synthesis of Oligopeptides as Antiviral Drugs for Rabies
19	Ms. Krutika Nandkumar Patil	Toxicology	Dr. Mrunal Ghag-Sawant	Discontinued
20	Mr. Vighnesh Vasant Shinde	Chemotherapy	Dr. Ashish Asrondkar	Optimization of Menthol Modified BSA Nanoparticle.
21	Ms. Padmaja Bhalchandra Valanjoo	Chemotherapy	Dr. Vrushali Patil	Bioinformatics
22	Ms. Bhagyeshri Suresh Gaikwad	Zoonosis/VAU/ Toxicology	Dr. Mrunal Ghag-Sawant	Monitoring of Insecticide Resistance and Genetic Variation in Mosquito Vector in and around South Mumbai



Museum

Museum

2020-21 and 2021-22



Dr. Mrunal Ghag-Sawant

In charge of Museum
(08/01/2021 to 19/10/2021))



Dr. Shashikant Vaidya

In charge of Museum
(20/10/2021 to 31/03/2022)

Overview

The Museum in the Historic renowned mansion with Portuguese architecture is a magnificent museum which unveils Life Sciences, Microbiology and the glorious past of this Institute and the inspirational work of Dr. Waldemar Mordecai Haffkine.

It has a short Film "The World of Dr. Haffkine" made by Films Division in 1976.

It also has snake section, with original skeletons of grown up and baby snakes. A wet display of semi non-venomous and venomous snakes can be found here, apart from replica of various crawling and flying insects like mosquitoes, flies, cockroaches and bed bugs. Some original insect collections on display have been collected way back in 1924. The shaded snake skins and instruments used for handling snakes are also displayed. A film explaining milking of snake venom and original snake venom is also available for viewing. Transparent sculptures of enlarged forms of five most significant microbes namely Human Immunodeficiency Virus (HIV), Rabies Virus, Influenza Virus, *E. coli* and Bacteriophage are on display.

List of Guest visited Museum at Haffkine Institute (January 2020- March 2021)

Sr. No	Date of Visit	Name of Visitor	Organization
1	06//01/2020	Dr. Amiral Jain	T.N.M.C. and B.Y. Nair Hospital Mumbai
2	08/01/2020	Mr. Satish Sridhar Bhosale	Dadar
3	16/01/2020	Ms. Shrutika Shewale	Mumbai
4	16/01/2020	Dr. Daisha Patel	T.N.M.C. and B.Y. Nair Hospital Mumbai
5	21/01/2020	Mr. Ravindra Rao	Voltas Limited
6	30/01/2020	Dr. Mahesh R. Jawale	Nagpur Veterinary Collage, Nagpur
7	04/02/2020	Mr. Udaykumar Reddy	Biotechnology Dept. C.H.M Collage, Ulhasnagar
8	24/02/2020	Mr. Vinayak Talwar	Khaki Heritage Foundation
9	25/02/2020	Nursing Student	University of Nursing, Faridkot, Punjab
10	28/02/2020	Major B. leinor	INHS Ashwini, Mumbai
11	01/12/2020	Dr. Sandeep Rathod, IAS	MD – Haffkine Bio-pharmaceutical Limited
12	18/12/2020	Mr. Vikas Dilwari	Conservation Architect
13	01/02/2021	Mr. Dinesh Doke	Additional Commissioner Pune
14	12/03/2021	Dr. Krishanu Ray	Dept. of Biological Science – TIFR- Mumbai
15	20/03/2021	Shri. Uddhav Balasaheb Thakre	Hon. Chief Minister – Maharashtra state

List of Groups visited Museum at Haffkine Institute (January 2020- March 2021)

Sr. No	Date of Visit	Name of Visitor	No of Visitors
1	12/03/2020	Staff of HBPC under L.W. Program	40
2	03/09/2020	Data Entry Staff – Virology (Covid -19)	08
3	31/10/2020	OSD and staff of Hon. Minister Shri. Dhananjay Munde	20
4	04/11/2020	Shri, Amit Deshmukh , Hon. Minister of Medical Education Department + 14 staff members	15

Visitors Photo's (2020-21)



Shri. Uddhav Thakare - Hon. Chief Minister, Maharashtra
Visited Museum on 20/03/2021



**Shri Amit Deshmukh- Hon. Minister Medical Education Department, Maharashtra
visited Museum on 4/11/2020**

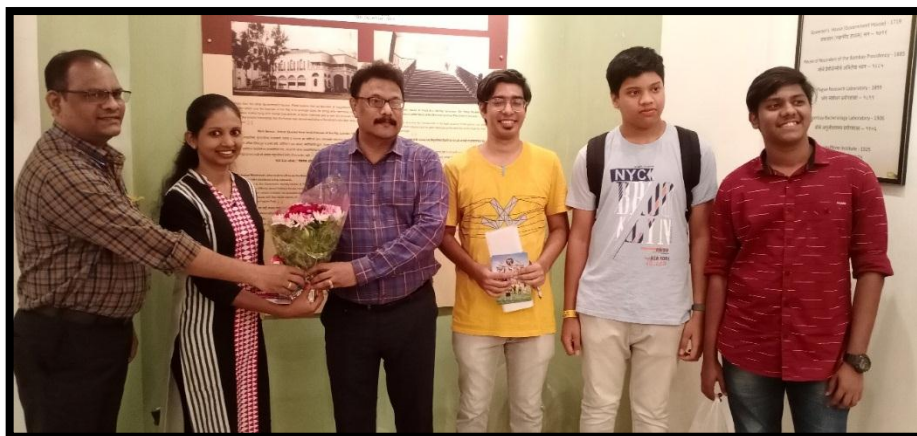
List of Guest visited Museum at Haffkine Institute (January 2021- March 2022)

Sr. No	Date of Visit	Name of Visitor	Organisation
1	12/10/2021	Dr. Rashmi Fadnis	Lokmanya Seva Sangh Society, Mumbai
2	23/10/2021	Amyr & Daner Narjee	Arvika Life, LLC (USA)
3	16/11/2021	Dr. Rajendra B. Shingane	Minister - FDA
4	18/11/2021	Omprakash Sadhwani	Joint Commissioner & Drug Controller- FDA
5	18/11/2021	Ram Banarse	Former Asst. Commissioner –FDA
6	14/12/2021	Varsha Goverdhan	Director – VSGPL
7	14/12/2021	Yadhav	Consultant –HBPCL
8	04/02/2022	Virendra Singh. IAS	Commissioner- Medical Education and Research
9	16/02/2022	Dr. Madhavi Khode Chaware	Managing Director- HBPC
10	20/04/2022	Mr. Nashir Lanangia	Licence Guide- MTDC
11	27/04/2022	Dr. Prajakta Parvatikar	Principal- Rchana Sasand Collge of Applied Art and Craft.
12	12/05/2022	Jency Amali	Father Muller Medical Collage- Bangalore
13	12/05/2022	Ishaan Gandhi	Ramaih Collage -Bangalore
14	18/05/2022	Prathamesh Deshpande	Anam Prem NGO
15	20/05/2022	Mr. Sainath V. Gandwal	Section Officer- MEDD Maharashtra State.

Collaborations and Events

- Collaboration and Participation in the International exhibition on “Hunt For vaccine” through digital means organized by the Nehru Science Center Mumbai.
- Celebrated “World Museum Day” on 18th May-2022.
- Celebrated Museum week on the occasion of “World Museum Day” from 16th May to 20th May 2022.

Museum was kept open for all staff, Student and visitors in working hours.



On the occasion of “**World Museum Day**” on 18th May-2022
Team of **Anam Prem NGO** visited our Museum and felicitated our Museum Team



Mr. Sainath V. Gandwal, Section Officer- MEDD Maharashtra State
visited our Museum on the closing day of Museum Week

Museum Administrative Team (2021-22)



Museum Administrative Team (2021-22)



Dr. Shashikant Vaidya – In charge -Museum



**Mr. Pradeep J Jadhav
Museum Co-ordinator**



**Mr. Nilesh Gaikwad
Museum Co-ordinator**

Publication

Publications

2020-21 and 2021-22

Research Articles

2020-21

- 1 Behera Suchismita, Pharande Rajesh Raghunath, Reddy R. Rajendra, Majee Sharmila B, Mukherjee Sandeepan, Suryawanshi Amol Ratnakar. Quantitative proteomics leads to identify dog brain proteins involved in rabies virus infection: implication in understanding viral pathophysiology. J Proteins Proteom, 2020. doi.org/10.1007/s42485-020-00051-w.
- 2 Chachad D.P, Dias,A., Uniyal,K., Varma,U. Jadhav,P., Satvekar T., Ghag – Sawant.M, Chemical characterization; Antimicrobial and Larvicidal activity of essential oil from Callistemon citrinus (Bottle brush) leaves February, 2021
- 3 Dabholkar A, Kariyil B, Vaidya S, Rani S, Nisha A, Krishna B. In vitro evaluation of Carbosulfan for its Carcenogenic effect in Balb/c 3T3 cell line. 2021.
- 4 Jadhav K. B, Ghag Sawant M.S, Satvekar T.A, Nagarkar J. M. Biopesticide formulations of karanj and castor oil using soapnut. Dispersion Science and Technology, 2020. doi:10.1080/01932691.2020.1841001.
- 5 Kaskar S, Rachamalla N, Overton K, Hamilton L, Evans J, Bradley L, Harner T, Vaidya S, Rooker R, Morales D. Occurrence of food insecurity in Ohio, USA household woman population. International Journal of Applied Research, 2020, 6(7), 501-507.
- 6 Kaskar S, Rachamalla N, Overton K, Hamilton L, Evans J, Bradley L, Harner T, Vaidya S, Rooker R, Morales D. 2020. Determination of food insecurity and negative health indicators in Ohio, USA. International Journal of Applied Research, 2020, 6(7), 198-205.
- 7 Kaskar Shagufta, Rachamalla Niveditha, Overton Kirby, Hamilton Linda, Harner Tommie, Vaidya Shashikant, Rooker Ron, Morales Dianna. Prevalence of food insecurity in low-income population in Ohio, USA. International Journal of Applied Research, 2020.
- 8 Mathen C, Ghag Sawant M, Gupta R. Evaluation of potential application of Wharton's Jelly-derived Human Mesenchymal Stromal Cells and its Conditioned Media for Dermal Regeneration using Rat Wound Healing model Cells Tissues Organs. March 2021, doi: 10.1159/000513895.
- 9 Mukherjee S, Talele G, Chowdhary A, Vaidya S, Deshmukh R, Rawal R, Shah R. Preparation of Coronavirus nosodes sourced from a clinical sample of SARS-Cov-2 positive patients, inactivated strain, and spike glycoprotein. International Journal of High Dilution Research (IJHDR), 2020, 19(4), 02-09.

- 10 Naik A.A, Dandekar S.P, Naik N. Effect of Indian honey on expression of p53 and cyclin B1 in HeLa cells. Indian Journal of Biochemistry & Biophysics, 57, 178-184, 2020.
- 11 Patil M, Padhye S, Nair R. Nanosilica for Sustained Release of Quercetin and its Antioxidant Activity. International Journal of Innovative Science and Research Technology, May 2019, 4(5).
- 12 Padmanabhan U, Mukherjee S, Borse R, Joshi S, Deshmukh R. Phase II Clinical Trial for evaluating BCG as a potential therapy for Covid-19. MedXRiv, 2020.
- 13 Pharande Rajesh Raghunanth, Majee Sharmila Badal, Gaikwad Satish S, Moregoankar S D, Bannaliker AnilKumar, Doiphode Aakash, Gandge Rajashri, Dighe Dhananjay, Inagle Sonal, Mukherjee Sandeepan. Evolutionary analysis of rabies virus by using partial Nucleoprotein and Glycoprotein gene in Mumbai region in India. Journal of General Virology, March 2021, 102(3). doi: 10.1099/jgv.0.001521.
- 14 Shaikh Sarfaraz, Dhavan Pratik, Singh Pinky, Uparkar Jasmin, Vaidya S. P, Jadhav B. L, Ramana M. V. Synthesis of carbazole based α -aminophosphonate derivatives: design, molecular docking and in vitro cholinesterase activity. Journal of Biomolecular Structure and Dynamics, Taylor & Francis, 2020, 1-23.
- 15 Shaikh S, Pavale G, Dhavan P, Singh P, Uparkar J, Vaidya S. P, Jadhav B. L, Ramana, M. M.V. Design, synthesis and evaluation of dihydropyranoindole derivatives as potential cholinesterase inhibitors against Alzheimer's disease. Bioorganic Chemistry, 2021,110, 104770.

2021-22

- 1 Gupta Priyanka, Padmanabhan Usha, et al. Sequences of Corona virus variants observed in the period May - Aug 2020 in India. 2022, Submitted to GenBank, National Institutes of Health, U.S.A.
- 2 Panchal R, Bapat S, Mukherjee S, Chowdhary A. In silico binding analysis of lutein and rosmarinic acid against envelope domain III protein of dengue virus. Indian J Pharmacol. 2021, 53(6), 471.
- 3 Paradkar Prasad N, Sahasrabudhe Pallavi R, Ghag Sawant Mrunal, Mukherjee Sandeepan, Blasdel Kim R. Towards Integrated Management of Dengue in Mumbai. Viruses. December 2021, 13(12), doi: 10.3390/v13122436.

2020-21

Conference Paper

- 1 Vaidya S, Maniar J, Sharma J. In-vitro effect of bioactive fractions of Cinnamomum verum (Cv) on cytokine levels in Mycobacterium tuberculosis (MTB) infected Macrophages. Eur Respiratory Soc, 2020.

Abstract Published

- 1 Vaidya S, Bethala D. Identification of ligand receptor interaction across blood brain barrier in dengue pathogenesis, BMC Infectious Diseases 2020, 20(Suppl 1), ISSHID, 2020. pp 6.

2021-22

In-communication

- 1 Mala Menon, Mala, Pendhari Juber, Savla Hemali, Bethala Durga, Vaidya Shashikant, Shinde Ujwala. Mitochondria targeted liposomes of Metformin for improved Anticancer activity: Preparation and Evaluation. Journal of Drug Delivery Science and Technology. Manuscript Number: JDDST-D-22-01240.

Training Services

TRAINING SERVICES

2020-21

Department of Biochemistry

Training

A new program called Advanced Research Techniques (ART) has been initiated in the department in the year 2020-2021.

Students

1. One M.Sc. student has been appointed

Title: Isolation and characterization of monoclonal antibody

Student name: Ms. Rohini Boywar **Name of guide:** Dr. Usha Padmanabhan

Department: Department of Biochemistry

2. Two S. T. R. I. P. students were appointed

A. **Title:** Isolation of monoclonal antibody from serum.

Student name: Ms. Meenakshi Pawar

Name of Mentor: Dr. Usha Padmanabhan

Department: Department of Biochemistry.

B. **Title:** Assessment of wound healing activity of medicinal plant.

Student name: Ms. Saundarya Prithviraj

Name of Mentor: Dr. Amruta Naik

Department: Department of Biochemistry.

3. One ART student has been appointed

Sr.No.	Name of the Training Service	Amount
1	STRIP (2 students)	Rs.50,000/-
2	A.R.T. Student	Rs.21,000/-
	Total	Rs.71,000/-

Department of Cell Biology

Training

A new program called Advanced Research Techniques (ART) has been initiated in the department in the year 2020-2021.

Students

1. One M.Sc. student has been appointed

Title: Effect of Beta estradiol on gonadal development in chick embryo

Student name: Ms. Khadija Khan

Name of guide: Dr. Usha Padmanabhan

Department: Department of Biochemistry

2. One STRIP student was appointed

Title: Isolation of monoclonal antibody from serum.

Student name: Ms. Vidya kumbhar

Name of Mentor: Dr. Usha Padmanabhan

Department: Department of Biochemistry

3. One ART student has completed her work

Sr.No.	Name of the Training Service	Amount
1	STRIP Students	Rs.25,000/-
2	A.R.T. Student	Rs.21,000/-
	Total	Rs.46,000/-

Department of Clinical Pathology

Training

Following new departmental programs has been approved.

1. Techniques of Microbiology.
2. Infection Control and Prevention in Healthcare Setting.
3. Basic Techniques of Mycobacteriology.

Students

One STRIP student was appointed

1. **Title:** Activity of various rhizome extracts of Black turmeric against tuberculosis/drug resistant bacteria.

Student name: Ms. Shasanka Rabindra Sahu

Name of Mentor: Dr. S. P. Vaidya

Department: Department of Clinical Pathology

Sr.No.	Name of the training service	Amount
1	STRIP students	Rs.25,000/-
	Total	Rs.25,000/-

Department of Chemotherapy

Training

Two new program on HPLC and GCMS instruments has been initiated in the department.

1. Hands on training on HPLC (01 Month)
2. Advance training on GCMS (01 Month)

Students

One STRIP student was appointed

1. **Title:** Synthesis and characterization of menthol modified albumin nanoparticles.

Student Name: Mr. Afshan Rizvi

Name of Mentor: Dr. Vrushali Patil (PI)

Department: Department of Chemotherapy

Sr. No.	Name of Training Services and No. of Students	Total Revenue Generated
1	6 Months STRIP students (01)	Rs.25,000/-
2	45 Days Training for analytical Chemistry students (03)	Rs.21,000/-
3	1 Month Training for graduates and undergraduates (05)	Rs.25,000/-
4	6 Months STRIP students (01)	Rs.25,000/-
	Total	Rs.86,000/-

Department of Zoonosis

Training

One STRIP student was appointed

1. **Title:** Comparative study of green synthesized zinc nanoparticles and methanolic extract of *Cestrum nocturnum* and *Ervatamia coronaria* on larvicidal potential, histopathological alterations and behavioral changes against *Aedes aegypti*

Student name: Ms. Nandini Darji

Name of Mentor: Dr. Mrunal Ghag Sawant

Department: Department of Zoonosis

Sr. No.	Name of Strip Student	Revenue
1.	Nandini Darji	25000/-
	Total	25000/-

TRAINING SERVICES

2021-22

Department of Bacteriology

Training

Sr. No	Department	Name of Training Program	Number of Students	Revenue (Rs.)
1	Bacteriology	Short Term Research Internship Program (STRIP)	2	50,000/-

Department of Biochemistry

Training

A new program called Advanced Research Techniques (ART) was initiated in the department.

Sr. No	Name of Training Program	Period over which conducted	No. of students	Min. Qualification of students eligible for the course
1	M.Sc. Ph.D.	2021 onwards	Nil	MSc, B.Sc.
2	S.T.R.I.P	2021 onwards	3	M.Tech. B.Tech. M.Sc., B.Sc.,
3	A.R.T	2021 onwards	2	B.Sc., B.Tech

Students

Details of Three S. T. R. I. P. students

1. Title: Isolation of monoclonal antibody from serum.

Student Name: Ms. Meenakshi Pawar

Name of Mentor: Dr. Usha Padmanabhan

2. Title: Assessment of wound healing activity of medicinal plant.

Student Name: Ms. Saundarya Prithviraj

Name of Mentor: Dr. Amruta Naik

3. Title: Techniques of Animal cell culture.

Student Name: Ms. Avdhut Pawar

Name of Mentor: Dr. Amruta Naik

Details of Two A.R.T. students

1. Ms. Ritika Uday Gaitonde
2. Ms. Jasmine Mukesh Chughasrani

Department of Cell Biology

Training

A new program called Advanced Research Techniques (ART) was initiated in the department.

Sr. No	Name of Training Program conducted by Department	Period over which conducted	No. of students	Min. Qualification of students eligible for the course
1	M.Sc. Ph.D.	2017 onwards	3 (2 M.Sc.), 1 Ph.D. scholar present	M.Sc., B.Sc.
2	S.T.R.I.P	2017 onwards	8	M.Tech., B. Tech. M.Sc., B.Sc.,
3	A.R.T	2020 onwards	6	B.Sc., B.Tech.

Students

1. One Ph.D. student has joined

Title: Determination of variation in IGHV and IGLV genes in a healthy and CLL populations

Student name: Ms. Gauri Raje

Name of guide: Dr. Usha Padmanabhan

Department: Department of Cell Biology

2. Two S. T. R. I. P. students were appointed

a. Ms. Snehal Annadate (B tech from DY Patil, Dec 21 - Jun 22)

b. Ms. Shruti Mahajan (BSc from Aurangabad, Completed, Oct 21 - April 22)

Name of Mentor: Dr. Usha Padmanabhan

Department: Department of Cell Biology.

3. A. R.T Students

- Mr. Shantanu Dighe (MSc from Pillai College, joined April 22)
- Ms. Sukhada (joined April 22)
- Mr. Eon Lobo (joined May 22)

Through word of mouth publicity, students join the department for hands-on experience.

Students are well placed as below:

- One student has is regional technical manager in pathology products.
- One student in a research side of a Pharma company.
- One is Acting Head, Pathology, Metropolis diagnostics.
- One is doing her M.Tech.
- Two students have joined foreign universities on the basis of their experience and letters of recommendation from the department.
- Others are in process of applying for higher education.

Chemical Testing Department

Training

One STRIP student appointed as follows:

- Title** - To determine Neutraceutical Potential and Antimicrobial Potential of Powder Of Dried Hibiscus Flowers.

Student Name – Mr. Atish Shantaram Dongarkar

Name of Guide – Mrs. Suvarna Pachpore

Department – Chemical Testing Department

Sr.No	Name of Training Service	Total Revenue Generated (Rs.)
1	4-6 Months STRIP Student (1)	25,000/-

Department of Chemotherapy

Training

Sr. No	Name of Training Service and No. of Students	Total Revenue Generated (Rs)
1	3 Month Training for Biotechnology students (9)	Rs 1,35,000.00
2	45 Days Training for analytical Chemistry students (2)	Rs 15,000.00
3	1 Month Training for graduates & undergraduates (20)	Rs 1,00,000.00
4	6 Months STRIP students (04)	Rs 1,00,000.00
	Total	Rs 3,80,000.00

Department of Clinical Pathology

Following new departmental programs has been approved,

1. Techniques of Microbiology.
2. Infection Control & prevention in Healthcare Setting
3. Basic Techniques of Mycobacteriology.

Staff of the department is also participated in Institutional Annual Biotechnology Programme.

Students

Three S. T. R. I. P. students were appointed

1. **Title:** Gene expression studies of influenza virus-infected host cells.

Student Name: Ms. Sarah Khatkhatayr

Name of Mentor: Dr.S.P.Vaidya

Department: Department of Clinical Pathology.

2. **Title:** Investigation of the Anti-TB activity of a crude plant extract on mammalian cell lines.

Student Name: Ms. Ragini Mahajan

Name of Mentor: Dr.S.P.Vaidya

Department: Department of Clinical Pathology.

3. **Title:** Genotypic characterization of MRSA (Methicillin Resistant Staphylococcus aureus)
isolated from touch sites of Mumbai Suburban Railways

Student Name: Ms. Adhiti Rautmare

Name of Mentor: Dr.S.P.Vaidya

Department of Clinical Pathology

Sr. No.	Name	Amount
1	Ms. Sarah Khatkhatay	Rs.25,000/-
2	Ms. Ragini Mahajan	Rs.25,000/-
3	Ms..Adhiti Rautmare	Rs.25,000
	Total	Rs.75,000/-

2020-21 and 2021-22

1. Identification of ligand receptor interactions across blood brain barrier inviral neuro-pathogenesis.(Extramural Funding)

Team

- Dr. Shashikant Vaidya (P.I.) &
- Ms. Durga Bethala (DST-INSPIRE- SRF)

Funding Agency - Department of Science and Technology, Govt. of India

Duration - March 2017- April 2022

Budget - Rs. 24,16,069/-

2. Quantitative phosphoproteome profiling of circulating influenza virus strains in Mumbai region.

Team

- Dr. Shashikant Vaidya (P.I.) &
- Ms. Pinky Singh (Ph.D. Student)

Funding Agency - Haffkine Institute

Duration - Dec 2017- Dec 2022

Budget - 5 lakhs

2021-22

1. Newton Bhaha PhD Placement Programme

Team

- Dr. Olena Riabinina (PI)
Assistant Professor, Department of Biosciences, Durham University, UK
- Dr. Shashikant Vaidya (Co-PI)
Assistant Director & HOD, Clinical Pathology Department
- Ms. Durga Bethala, DST-INSPIRE-SRF

Funding Agency – The grant is presented by the Department of Business Energy & Industrial Strategy (BEIS), UK & Ministry of Science and Technology, India, along with the British Council, India and the Department of Science and Technology (DST).

Project Duration - September 2021- January 2022

Budget - GBP 10200 (BEIS) and Rs.1, 15,000 (DST) or Rs.11, 55,160/- (Total Amount if converted in INR)

Department of Toxicology

Students

Two S. T. R. I. P. students were appointed

1. **Title:** : “Toxicity and Anti-Inflammatory Acitivity of 2- nitrothiazole”

Student Name: Mr. Shubham Kalaskar

Name of Mentor: Dr. Mrunal Ghagh Sawant

Department: Department of Toxicology

2. **Title:** “To develop Lc50 Range finding (RF) assay and Medial lethal concentration of (MLC50) of cobra venom in Zebra fish embryo

Student Name: Miss Krutika Patil

Name of Mentor: Dr. Mrunal Ghagh Sawant

Department: Department of Toxicology

Sr.No.	Name of the Training Services	Amount
1	STRIP Students	Rs.25,000/-
2	STRIP Students	Rs.25,000/-
	Total	Rs.50,000/-

Department of Zoonosis

Sr. No.	Name of Workshop	Date	No. of Participant	Revenue Generated
1.	World Zoonosis Day	06/07/2021	67	NCDC Funds
2.	World Mosquito Day	20/08/2021	58	NCDC Funds
3.	Introduction to Covert Existence of Snakes & Mission to Control Mosquito Menace”	24/03/2022 & 25/03/2022	57	NCDC Funds
4.	Mission to Control Mosquito Menace”	30/03/2022	19	NCDC Funds
5.	On the occasion of “World Zoonosis Day “Poster competition organized by department	06/07/2022	15	NCDC Funds
6.	On the occasion of “World Mosquito Day “Slogan competition organized by department	20/08/2022	27	NCDC Funds

Sr. No.	Name of Strip Student	Revenue
1.	Neha Dasale	25000/-
2.	Mayurakshi Thakur	25000/-
3.	Bhagyeshri Gaikwad	25000/-
	Total	75000/-



Testing Services

Testing Services

2020-21

Department of Bacteriology

Testing

Total Revenue Generated from Testing = **Rs. 15,44,500/-**

Department of Bacteriology		
Sr. No	Name of Testing Service (alphabetical)	No. of Samples
1	Air Sterilizer	2
2	Antimicrobial Susceptibility Testing	3
3	Antimicrobial Testing of Antimicrobial Coated Products	1
4	Chlorine Dioxide Estimation	1
5	Disinfectants	23
6	Water Purifier	1
7	Water Samples	25
	Total No. of samples	56

Department of Biochemistry

Testing

1. *In vitro* cytotoxicity of drugs / chemicals / herbal extracts / food products on cells
2. Snake venom and ASV testing
3. Industrial unit certifications

Sr. No	Name of Testing Service (alphabetical)	No. of sample
1.	Certification of Industrial Units	2
2.	Cyto-toxicity assay	15
3.	Venom testing	4
	Total No. of samples	21

Total Revenue Generated from Testing activities:

Rs.1, 63,312/- (Rs. 20,000 + 50,000 + 25,920 + 67,392)

Data of venom testing:

I. Protein estimation

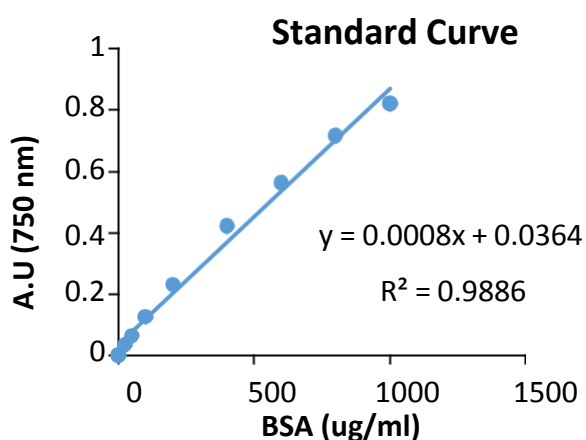


Table no. 2: Protein estimation of samples	
Sample	Protein (mg/ml)
CV	13.3
RV	14.3
KV	5.5
SSV	5.04

Figure 1: Standard curve for protein estimation using BSA.

[CV: Cobra venom, RV: Russel's Viper venom, KV: Krait venom, SSV: Saw scaled viper venom].

I. SDS PAGE

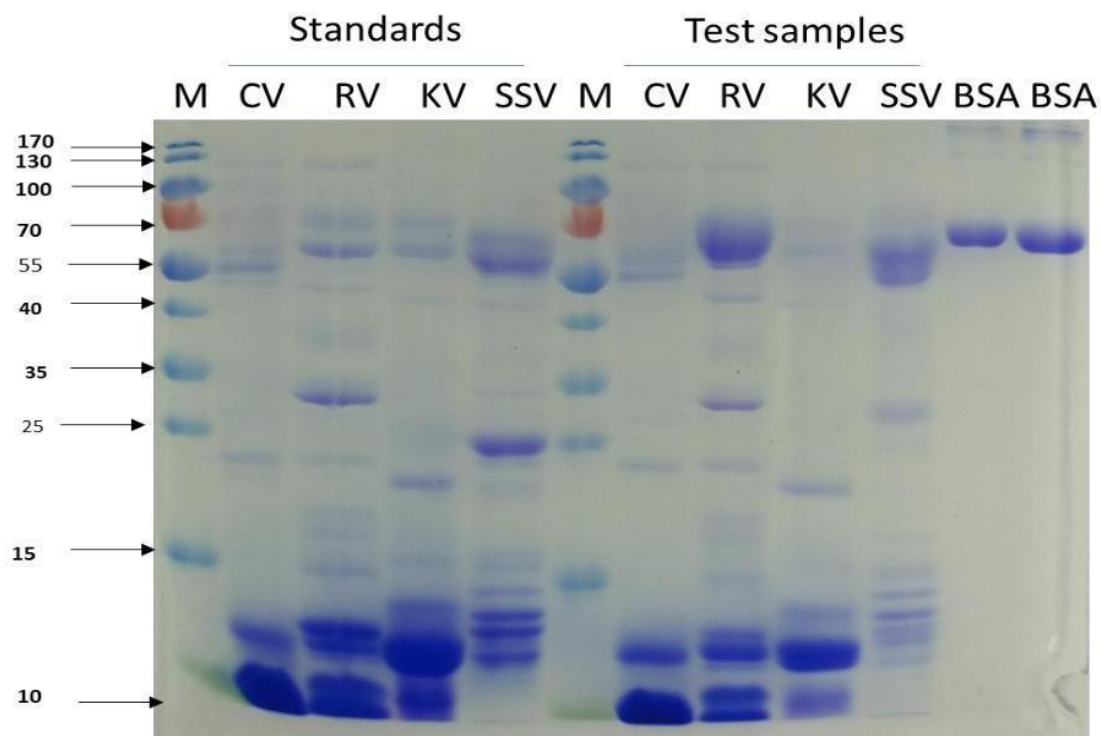


Figure 2: SDS-PAGE analysis of Standard and samples.M:

Molecular weight marker (Thermo scientific, #26616).

Shown on the left hand side are the molecular weights in KDa (kilo Daltons).

CV:	Cobra venom	(40 ug of standard or sample)
RV:	Russel's Viper venom	(40 ug of standard or sample)
KV:	Krait venom	(40 ug of standard or sample)
SSV:	Saw scaled viper venom	(40 ug of standard or sample)
BSA:	Bovine serum albumin	(2.5 ug & 5 ug, Mw = 66kDa)

I. Agar gel immunodiffusion

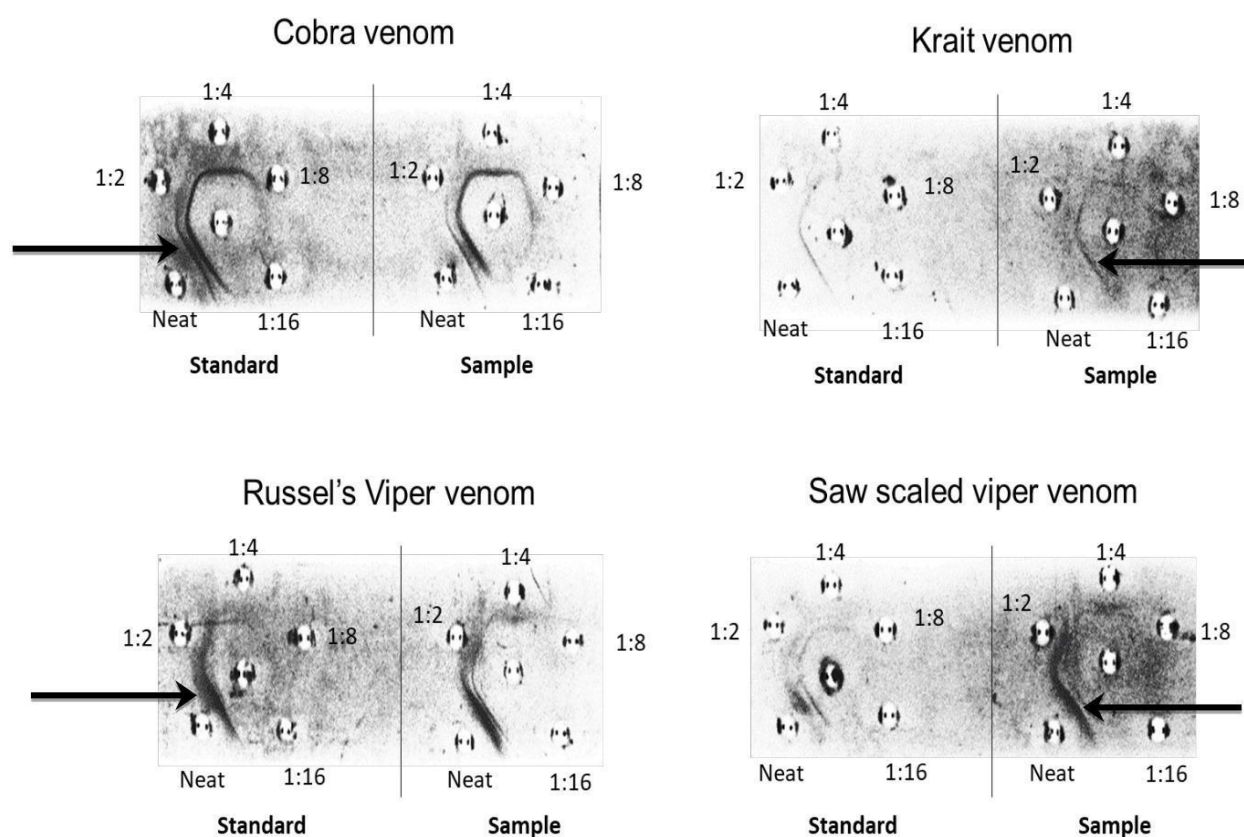


Figure 3: AGID analysis of Standard and samples.

Neat, 1:2, 1:4, 1:8, 1:16 indicates the dilutions of the ASV loaded on the corresponding wells. Arrow indicates the precipitation band. Absence of band indicates low precipitation due to low titer of antibody.

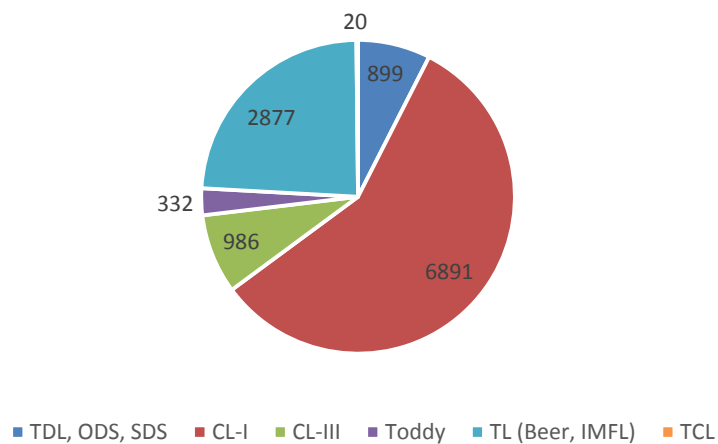
Department of Chemical Testing

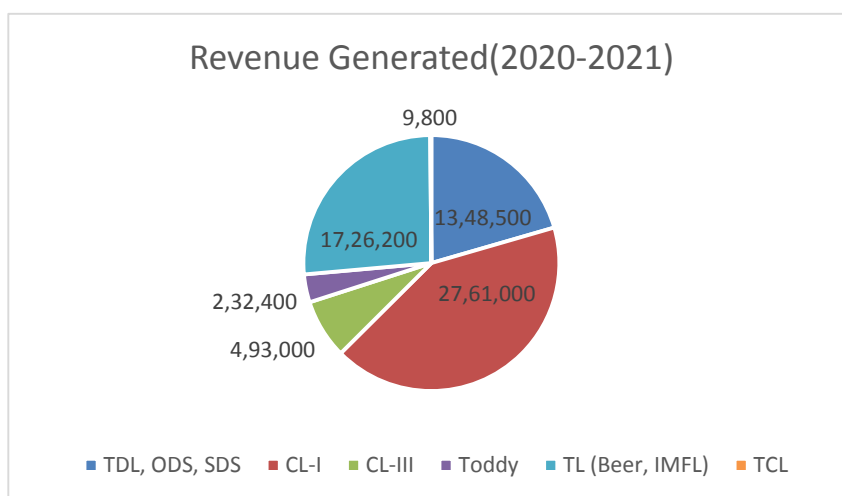
Testing

Total Revenue generated (1st April 2020 to 31 March 2021.) = Rs. 65,70,900/-

Serial No	Name of Testing Service	No. of samples Tested 1 st April 2020 to 31 st March 2021	Total Revenue generated (Rs.)
1	TDL, ODS, SDS	899	13,48,500
2	CL-I	6891	27,61,000
3	CL-III	986	4,93,000
4	Toddy	332	2,32,400
5	TL (Beer, IMFL)	2877	17,26,200
6	TCL	20	9,800
Total (Rs.)		12,005	65,70,900

Number.of samples tested (2020-2021)





Total Revenue Generated

Department of Chemotherapy

Testing

Total Revenue Generated from Testing = Rs.3,500/-

Commercial Samples:

Sr. No	Name of Testing Service and No. of Samples tested	Total Revenue Generated
1	Testing of samples using HPLC (07)	Rs.3,500/-

Department of Clinical Pathology

Testing

Total Revenue generated from Testing = **Rs. 17,60,385/-**

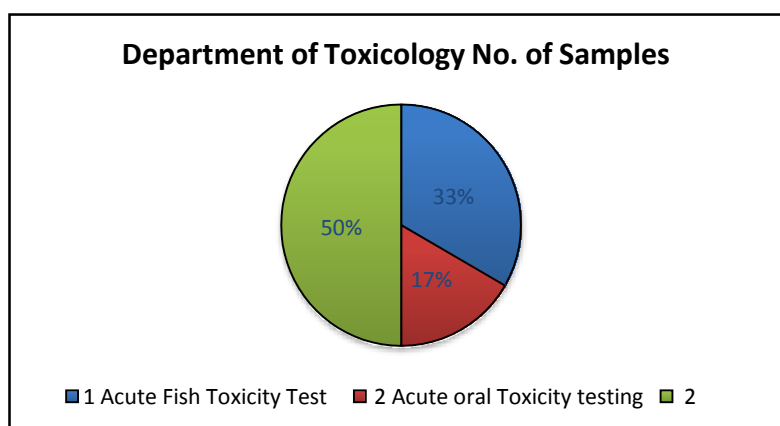
Department of Clinical Pathology		
Sr. No	Name of Testing Service	No. of Samples
1	Operation Theatre Swab	329
2	Swabs(MDS)	46
	Total No. of samples	375

Department of Toxicology

Testing

Total Revenue generated from Testing is **2.12 lakhs** INR.

Department of Toxicology		
Sr. No.	Name of Testing Service	No. of Samples
1	Acute Fish Toxicity Test	2
2	Acute oral Toxicity testing	1
	Total	3



Department of Virology

Testing

Total Revenue generated from Testing is Rs. **6,93,000/-**

Sr. No.	Name of Test	Revenue Generated (Rs.)
1	Detection of pH1N1 by qRT-PCR	Test Carried out free of cost Under NCDC – IDSP Project)
2	Detection of Rabies by qRT-PCR	Carried out free of cost Under NCDC –ISCP&CZD Project)
3	Detection of COVID-19 by qRT-PCR	Carried out free of cost Under ICMR & DMER funds
4	Evaluation of Virucidal Activity of Disinfectant/Products	6,93,000.00
	Total	6,93,000.00

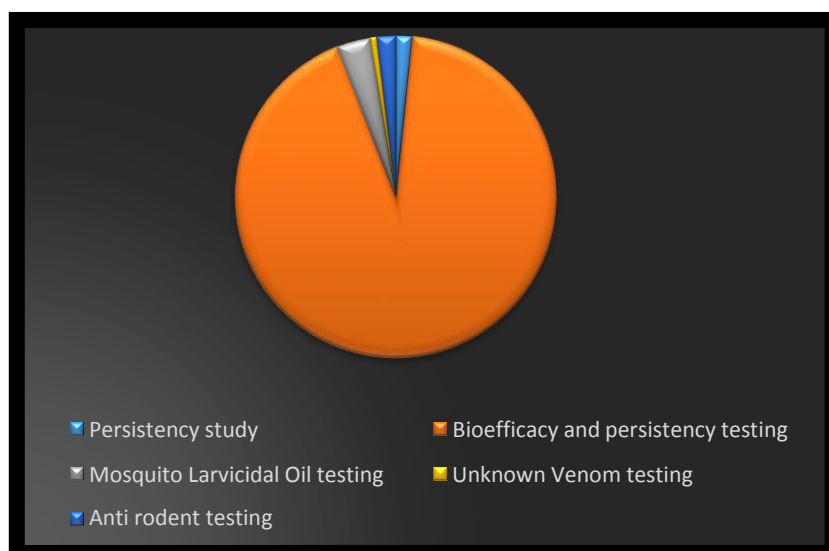
Sr. No	Name of Testing Service	No. of Samples Tested
1	pH1N1 Testing	00
2	Rabies Testing	06
3	COVID 19 Testing	34407
4	Evaluation of Virucidal Activity of Disinfectant/Products	06

Department of Zoonosis

Testing

Total Revenue generated from Testing is Rs. **31,98,965/-**

Department of Zoonosis			
Sr. No.	Name of Testing Service	No. of sample	Revenue Generated (Rs)
1.	Persistency testing (Synectics Bioscience Pvt. Ltd)	01	51,840/-
2.	Bioefficacy and Persistency of Temprid against housefly testing (Ross-Bayer)	01	13,99,680/-
3.	Bioefficacy testing of paint panels (Ross-Berger)	51	3,58,020/-
4.	Bioefficacy and Persistency of Quickbait against housefly testing (Bayer)	01	4,97,250/-
5.	Bioefficacy study of aerosol (Godrej)	01	2,38,680/-
6.	Bioefficacy and Persistency study against bedbug	01	4,77,360/-
7.	Mosquito Larvicidal Oil testing	02	1,08,720/-
8.	Unknown Venom testing	04	21,594/-
9.	Anti-rodent testing	01	58,565/-
Total No. of Samples		62	31,98,965/-



Total Revenue generated from Testing

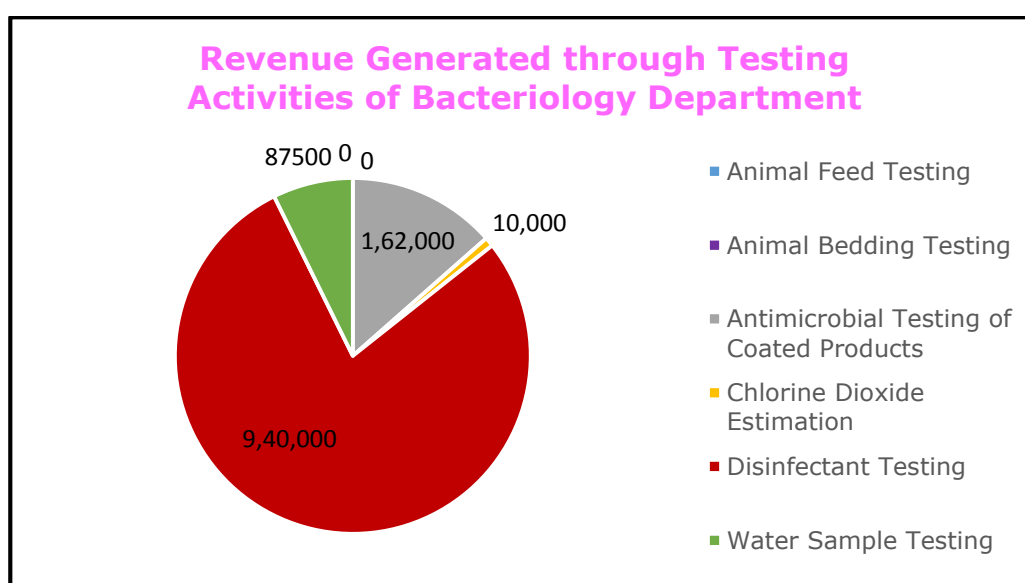
Testing Activities 2021-22

Department of Bacteriology

Testing

Total Revenue Generated from Testing is **Rs. 11,99,500/-**

Department of Bacteriology		
Sr. No	Name of Testing Service (alphabetical)	No. of Samples
1	Animal Feed Testing (Free- Institutional- VAU Department)	1
2	Animal Bedding Testing (Free- Institutional- VAU Department)	1
3	Antimicrobial Testing of Antimicrobial Coated Products	6
4	Chlorine Dioxide Estimation	1
5	Disinfectants	15
6	Water Samples (One Free- Institutional- VAU Department)	36
	Total No. of samples	60



Testing Activities of Bacteriology Department

Besides,

1. Staff of Department of Bacteriology was actively involved in testing of Novel Corona Virus (COVID-19) samples especially Aliquoting and RNA Extraction of samples. [Dr. Anuya Rege, (Senior Scientific Officer), Mrs. Jayashree More (Scientific Officer), Mrs. Amita Patil (Scientific Officer) and Mrs. Dipti Kolte (Senior Technical Assistant)]
2. Staff of Department of Bacteriology was actively involved in general work related to Novel Corona Virus (COVID-19) testing. [Mr. Jitendra Dalvi (Laboratory Assistant) and Mr. Ravindra Bire (Laboratory Assistant)]

Department of Biochemistry

Testing

The department used to conduct Biochemical testing on a routine basis. However due to lack of an MD Pathology, the testing activities have been stopped. Over the past year the department has requested that the Institute hire an MD pathology, to enable department to continue its testing activities. The department has sought permission to standardize Prostate serum antigen and BRCA genetic testing for prostate cancer and breast cancer diagnosis respectively. The department has been performing the in vitro cell based assays i.e. MTT assay, wound healing assay and currently have received the samples for the same. The department has been performing the in vitro biochemical assays for the snake venom analysis and anti-snake venom (ASV) analysis and currently standardizing the assay of ELISA for the same. The department was also involved in validation of RT-PCR kits from Haffkine Biopharma Corporation Ltd.

Department of Biochemistry		
Sr. No	Name of Testing Service	No. of sample
1.	COVID-19 RT-PCR Kit validation	4 kits of 80 samples each
	Total No. of samples	320 samples

Department of Cell Biology and Biochemistry

Testing

Sr. No	Name of Testing Service and No. of Samples tested
1.	Determination of genomic sequence of SARS Cov-2 variants & establishment of Internal SARS Cov-2 Database for accuracy of variants of calling

Analysis and Significance:

Global human health is increasingly challenged by emerging viral threats. In late December 2019, a new Betacoronavirus, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), appeared from the Chinese city of Wuhan and was later confirmed as the causative agent of a new severe form of pneumonia, coronavirus disease 2019 (COVID-19) [1]. The COVID-19 pandemic in India is a part of the worldwide pandemic of COVID-19. As of 4 May 2022, according to official figures, India has the second-highest number of confirmed cases in the world (after the United States of America) with 43,088,118 [2, 3].

SARS-CoV-2 consists of a positive-sense single-stranded RNA genome, spanning 29,903 nucleotides in length, and four structural proteins: N, S, E, and M.. The N (nucleocapsid), protein encapsulates the genome, while the S (spike), E (envelope), and M (membrane) proteins comprise the surrounding lipid bilayer envelope As shown is figure-1 [4], the genome size of SARS Cov-2 is approx. ~ 30 kb.

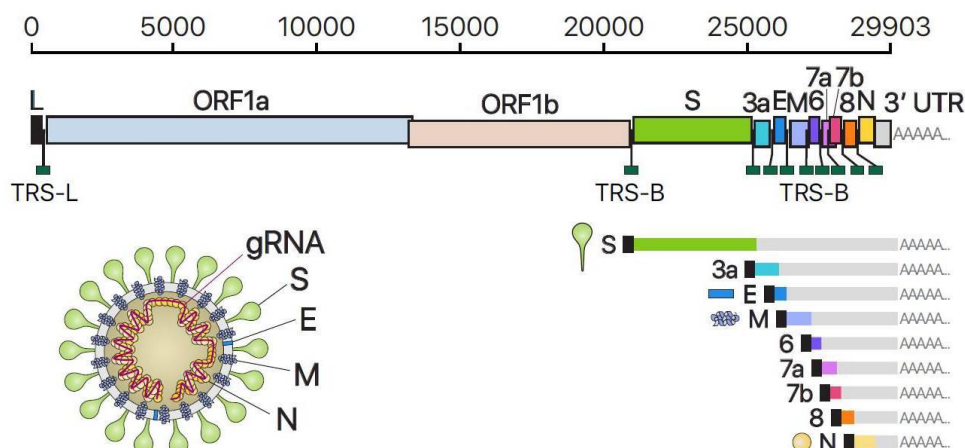


Figure-1 Schematic presentation of the SARS-CoV-2 genome organization, the canonical sub-genomic mRNAs, and the virus structure. Taken from Kim et al., 2020 [4].

Over the past 2 years from 2020 several variants of SARS Cov-2 have been identified [5]. These mutations and Variants of Interest have been identified though whole genome sequencing (WGS) of the COVID-19 viral genome.

The list of different variants are shown below the table-1 and phylogenetic relation of these clades also shown in figure -2.

Nextstrain Clade	Pango Lineage	WHO Label	Nextstrain Clade	Pango Lineage	WHO Label
20I (Alpha, V1)	B.1.1.7	α Alpha	21K (Omicron)	BA.1	o Omicron
20H (Beta, V2)	B.1.351	β Beta	21L (Omicron)	BA.2	o Omicron
20J (Gamma, V3)	P.1	γ Gamma	22A (Omicron)	BA.4	o Omicron
21A (Delta)	B.1.617.2	δ Delta	22B (Omicron)	BA.5	o Omicron
21I (Delta)		δ Delta	22C (Omicron)	BA.2.12.1	o Omicron
21J (Delta)		δ Delta	20E (EU1)	B.1.177	
21B (Kappa)	B.1.617.1	κ Kappa	20B/S:732A	B.1.1.519	
21C (Epsilon)	B.1.427, B.1.429	ε Epsilon	20A/S:126A	B.1.620	
21D (Eta)	B.1.525	η Eta	20A/EU2	B.1.160	
21F (Iota)	B.1.526	ι Iota	20A/S:439K	B.1.258	
21G (Lambda)	C.37	λ Lambda	20A/S:98F	B.1.221	
21H (Mu)	B.1.621	μ Mu	20C/S:80Y	B.1.367	
			20B/S:626S	B.1.1.277	
			20B/S:1122L	B.1.1.302	

Table-1 List of Different Variants of SARS-Cov-2. Adopted from: Emma B. Hodcroft et al, 2021

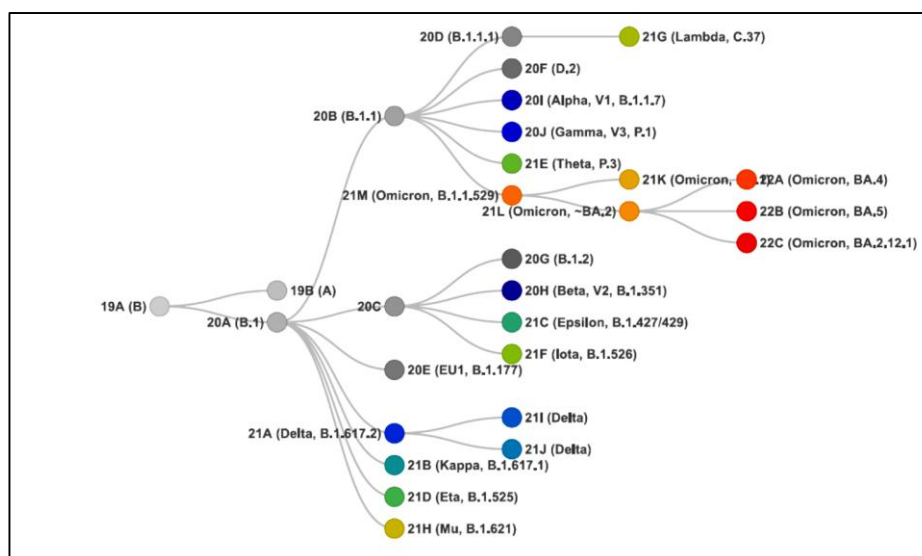


Figure-2 Phylogenetic relationships of Nextstrain SARS-CoV-2 clades. Adopted from: Emma B. Hodcroft. et al, 2021 [5].

The current SARS-CoV-2 pandemic necessitates the immediate implementation of a global decentralised surveillance system to detect local outbreaks and the appearance of emerging variations of concern [6].

Globally, Genome sequencing of COVID-19 world is carried out by two methods: either via Illumina or through Nanopore. Among available sequencing technologies, nanopore-sequencing (Oxford Nanopore Technologies) could be an important cornerstone, as it is mobile, scalable, and cost-effective.

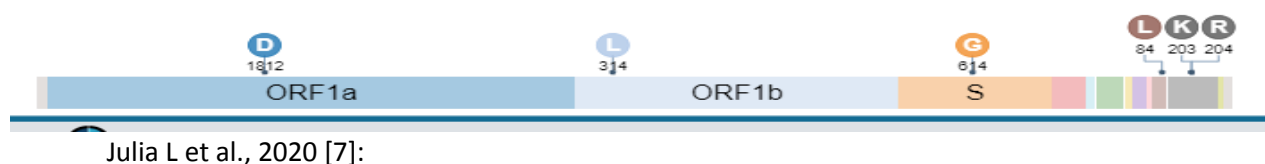
In our laboratory, we have standardized the Oxford Nanopore method of sequencing. Our aim was to determine the sequence of SARS Cov-2 variants using easily deployable next-generation sequencers, the small and hand-held MinION sequencer.

In brief the method used is as follows: The RNA genome is reverse transcribed and subjected to PCR using the ‘midnight’ split primer sets protocol which produce tiled overlapping amplicons (1200 bp), which cover almost the entire SARS-CoV-2 genome. Each sample is then tagged with a unique barcode (in the form of a DNA sequence). Adapters that target DNA to the nanopores are ligated. Finally the DNA is purified and loaded onto the MinION flowcells. Downstream bioinformatics analyses are performed with the help of inter-ARTIC bioinformatics pipeline as recommended by Oxford Nanopore Technologies.

Through this, we have sequenced SARS-Cov-2 samples from patients who have enrolled for the Clinical Trial (Ethics permission of which attached along with this application).

gene	amino acid
ORF1a	A1812D
ORF1b	P314L
S	D614G
ORF8	S84L
N	R203K
N	G204R

In India, the genome sequencing of COVID-19 mutant are monitored by Indian SARS-CoV-2 Consortium on Genomics or Indian SARS-CoV-2 Genetics Consortium (INSACOG), which has been establish by Department of Biotechnology by the Government of India. We have submitted data from sequencing of samples obtained during the clinical trial (the first-wave). Our data identify the strains at that time as B.1.1.306. This variant has characteristics is shown below



Julia L et al., 2020 [7]:

Figure 3: **Characteristic mutations of B.1.1.306**

Interestingly, a summary of this clade is as follows: As on date 2,142 sequences in the B.1.1.306 lineage have been detected since the lineage was identified:

Location	B.1.1.306 found		when found**	
	total	cumulative prevalence*	first	last
India#	1,873	1%	1 Mar 2020	15 Dec 2021
Worldwide	2,142	< 0.5%	1 Mar 2020	15 Dec 2021

In India this variant was found in Maharashtra, Uttarakhhand, and Telangana [7]

The time period and the location of variants matches with the time period and location of our study, adding further credibility to our data.

We are in the process of submitting this data to PubMed: NCBI

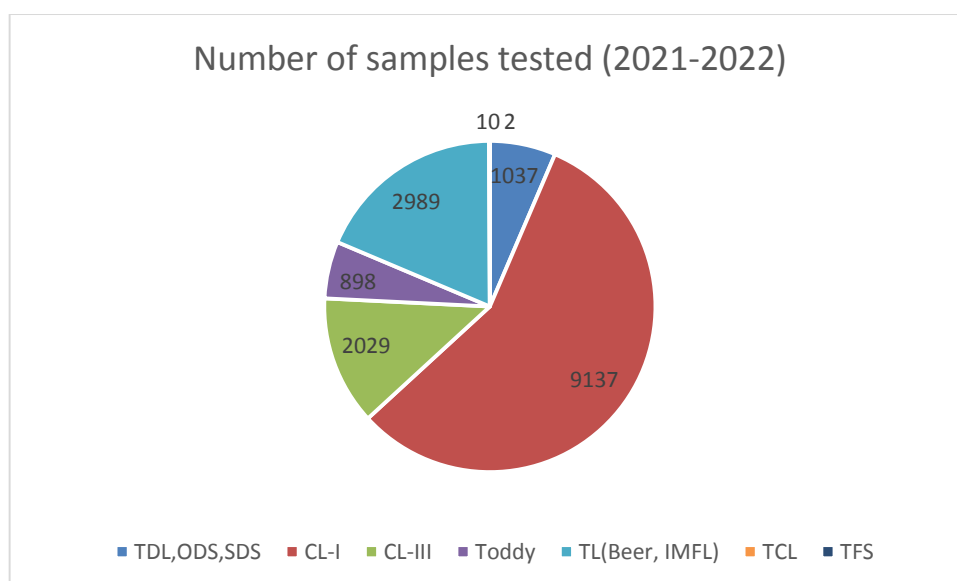
This testing is being conducted in collaboration with the Department of Biochemistry.

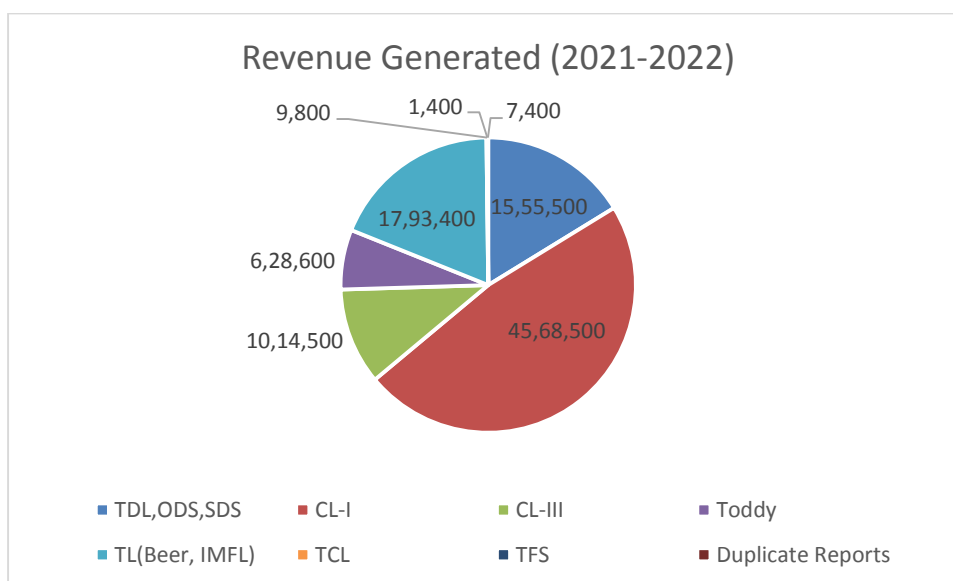
Department of Chemical Testing

Testing

Total Revenue generated (1st April 2021 to 31 March 2022.) = 95,79,100/-

Serial No.	Name of Testing Service	No. of Samples Tested 1 April 2021 to 31 March 2022	Total Revenue Generated (Rs.)
1	TDL,ODS,SDS	1037	15,55,500
2	CL-I	9137	45,68,500
3	CL-III	2029	10,14,500
4	Toddy	898	6,28,600
5	TL(Beer, IMFL)	2989	17,93,400
6	TCL	10	9,800
7	TFS	02	1,400
8	Duplicate Reports		7,400
Total (Rs)		16,102	95,79,100





Department of Clinical Pathology

Testing

Total Revenue Generated from Testing = **Rs. 387935/-**

Department of Clinical Pathology		
Sr. No	Name of Testing Service	No. of Samples
1	Operation Theatre Swab	523
2	Swabs (MDS)	21
3	Anti – tuberculosis Activity testing	3
	Total No. of samples	547

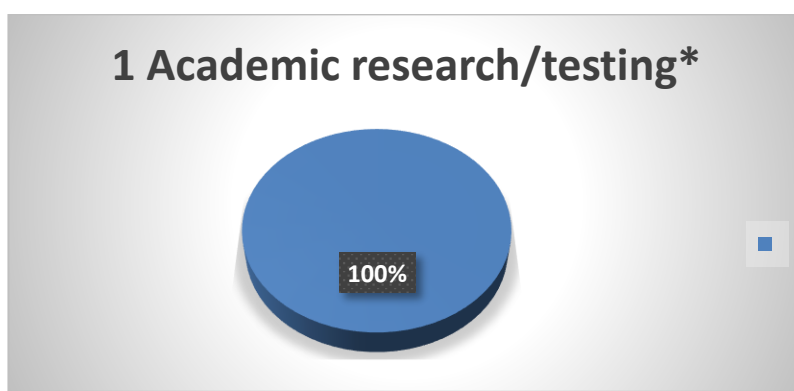
Department of Toxicology

Testing

Total Revenue Generated from Testing is **5.34 lakhs** INR.

Department of Toxicology		
Sr. No.	Name of Testing Service	No. of Samples
1	Academic research/testing*	2
	Total	2

Academic research/testing: This is academic research wherein charges are applied for designed and implementation of research as collaborator.



Pie chart of revenue

Department of Virology

Testing

Sr. No.	Name of Test	Revenue Generated (Rs.)
1	Detection of pH1N1 by qRT-PCR	Test Carried out free of cost Under NCDC – IDSP Project)
2	Detection of Rabies by qRT-PCR	Carried out free of cost Under NCDC – Project)
3	Detection of COVID-19 by qRT-PCR	Carried out free of cost Under ICMR & DMER funds
4	Evaluation of Virucidal Activity of Disinfectant/Products	78,000/-

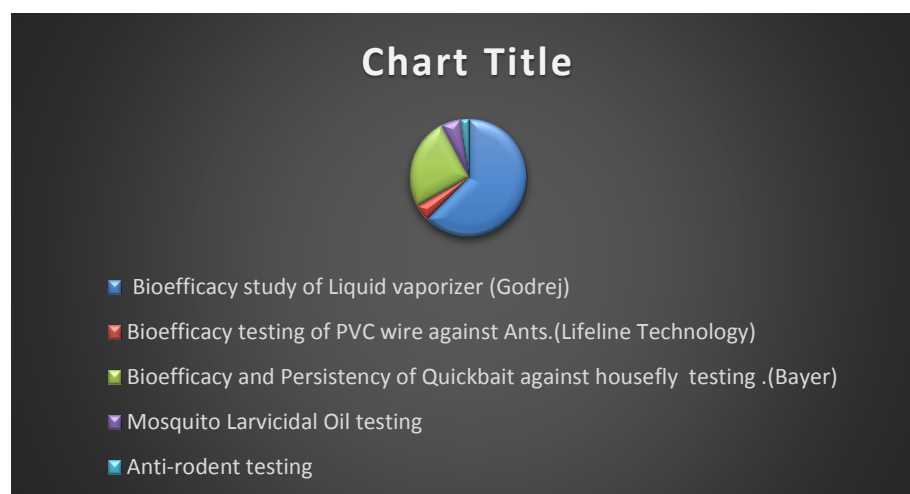
Sr. No	Name of Testing Service	No. of Sample
1	Rabies Testing	7
2	COVID 19 Testing	23416
3	Evaluation of Virucidal Activity of Disinfectant/Products	1

Department of Zoonosis

Testing

Total Revenue Generated from Testing is Rs. **19,08,900/-**

Department of Zoonosis			
Sr. No.	Name of Testing Service	No. of sample	Revenue Generated (Rs)
1.	Bioefficacy study of Liquid vaporizer (Godrej)	01	11,93400/-
2.	Bioefficacy testing of PVC wire against Ants.(Lifeline Technology)	01	83,520/-
3.	Bioefficacy and Persistency of Quickbait against housefly testing .(Bayer)	01	4,86,000/-
4.	Mosquito Larvicidal Oil testing	02	1,02,960/-
5.	Anti-rodent testing	01	43,020/-
Total No. of Samples		06	19,08,900/-



Total Revenue generated from Testing



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