# XAVIER RESEARCH FOUNDATION

## LOYOLA CENTRE FOR RESEARCH & DEVELOPMENT

(Recognized SIRO, DSIR, Govt. of India)
(Recognized Research Centre of GSFU, Gandhinagar)
St. Xavier's College Campus, Navrangpura, Ahmedabad-9.

www.xrf.res.in



# ANNUAL REPORT 2019-20




## VISION

Our vision is to catalyze, encourage, promote and support research in the humanities, social sciences and various branches of the regular sciences to address poverty alleviation and eradicate it in our country. We thus aspire to build an egalitarian world in which the fruits and progress of our current day knowledge society are at the service of the poorest of the poor of our earth home.

## MISSION

The mission of the Centre is to do research that propels innovation to fuel entrepreneurship, and to work with the marginalized and discriminated segments of our society, grassroots and rural communities on the fringes of our economy; and through training and handholding for entrepreneurship to empower them to set up production units of a micro, small and medium level for sustainable livelihoods. Through these interventions our ultimate mission is to develop our villages and rural areas as sustainable communities and environments

Cover Page

Top (L to R) : Planting of Kali Musli, Bhiloda women in the XRF Green House, PM 2.5 sampling being carried out at Pirana.

Middle (L to R) : Sub culture of Kali Musli bulbils, Dr. Disha Patel with the XRF Management after successful defense of her Ph.D. thesis, Training in Gel Electrophoresis.

Bottom (L to R) : Mr. Piruz Khambatta unveiling the Areez Khambatta Benevolent Trust *C. Elegans* laboratory, Ms. Dipal Joshi being felicitated by the Rector Dr. (Fr.) Vinayak Jadav on completing 25 years of service at XRF-LCRD.

# VALUES

We love to see the cactus bloom

# OUR MOTTO

Learn and Relearn,
Search and Research,
Create and Recreate.
To Build a Better Earth for all.

# OUR SLOGAN

Decimate Poverty! Do Innovative Research!!

# PREFACE

This annual report spans and covers our activities and achievements over more than a year. We wanted to bring the publication of our report in line with our working year, and so have tried to give an overview of our achievements and activities from the 1st of April 2019 to the 31st of May 2020, this year to begin with. Our future reports will hence forward cover the period 1st June 2020 to 31st May 2021 and so on in subsequent years.

In my previous year's preface I had weighed the option of a soft copy edition and based on a set of pros and cons, we had opted for a printed version. This year, however, it is evident to us that in the midst of the continuing Covid-19 global pandemic a soft copy edition is the best way forward. A culture has been created because of the circumstances we are in, that has made on-line communication inevitable, desirable and acceptable.

Curiously enough the two months that we have added to this report covers the months of April and May 2020, during which, due to the 'lockdown' imposed by the Government the LCRD had to be shut down. During this phase the labs and experiments and instruments had to remain unattended. A major electrical outage occurred and the backup system failed to kick in.

Given the nature of our research mandates, returning to the lab bench was of the highest priority. At the very first instance that it was permitted we got back to work. Every member of the staff demonstrated their commitment to duty and the institution, by reporting back the moment they were invited back. With commendable attention to safety as a sine qua non they took up and shared the responsibilities to sanitize the labs, and do an assessment of the damages due to the failure of the power system. My special appreciation for each of them for their conscientious response.

An important lesson that we have learnt is personal safety and responsibility, not only for one's own health but for that of our neighbor as well, is a must to keep everyone safe. As a research organization we have felt impelled to set in place SOPs to promote this and have willingly shared them with those around us.

On our return we discovered several major equipment had been damaged and will require replacement. Growth room plants that were in culture, and several strains of organisms have been destroyed including precious chemicals. The Greenhouse too suffered damages. Significant quantities of plant tissue culture products were lost. All in all a conservative estimate would sum up the damages at around twenty five lakhs. The most distressing part, however, is that our Ph.D. research scholars need some of the strains that were lost, since they are vital to their dissertation work. We are patiently but optimistically moving to restore these as soon as movement of goods globally takes off.

Notwithstanding our own difficulties, we responded to a call for support from a group of farmers, and made space available at the LCRD, so that their vegetables from their rural farms which were needing markets could be sold in Ahmedabad, where buyers were looking for fresh reliable produce. The outreach continues as a startup in collaboration with us, and has enabled jobs and income to quite a number of farmers.

We have also continued our program for livelihood options with the Adivasi women at Narukot, and have imparted to them the safety practices, so that they too can stay Covid free while pursuing their project with us. Safety is the key message we send out to each of you too. The old adage 'prevention is better than cure' is one hundred percent relevant to our Covid-19 situation today.

The pandemic has brought distress to many in so many different ways. But it has also demonstrated that we can rise above ourselves and go the extra mile to reach out in support. Heartened by this I take the courage to appeal to you to reach out to us to overcome the losses we have suffered. Any donation on your part will be gladly received and accepted (details given on inner back cover page). God bless you for your generosity in anticipation.

May the joy of your giving bring great energy to your life! Amen.

Dr. (Fr.) Vincent J. Braganza, s.j.
Director

# BOARD OF TRUSTEES

The Loyola Centre for Research and Development is administered and run by the Xavier Research Foundation (XRF). The Trustees of the Foundation are:

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विद्या विश्वविमुक्तये

*Completed 25 years*

*Going for Gold*

# XAVIER RESEARCH FOUNDATION

## ANNUAL REPORT

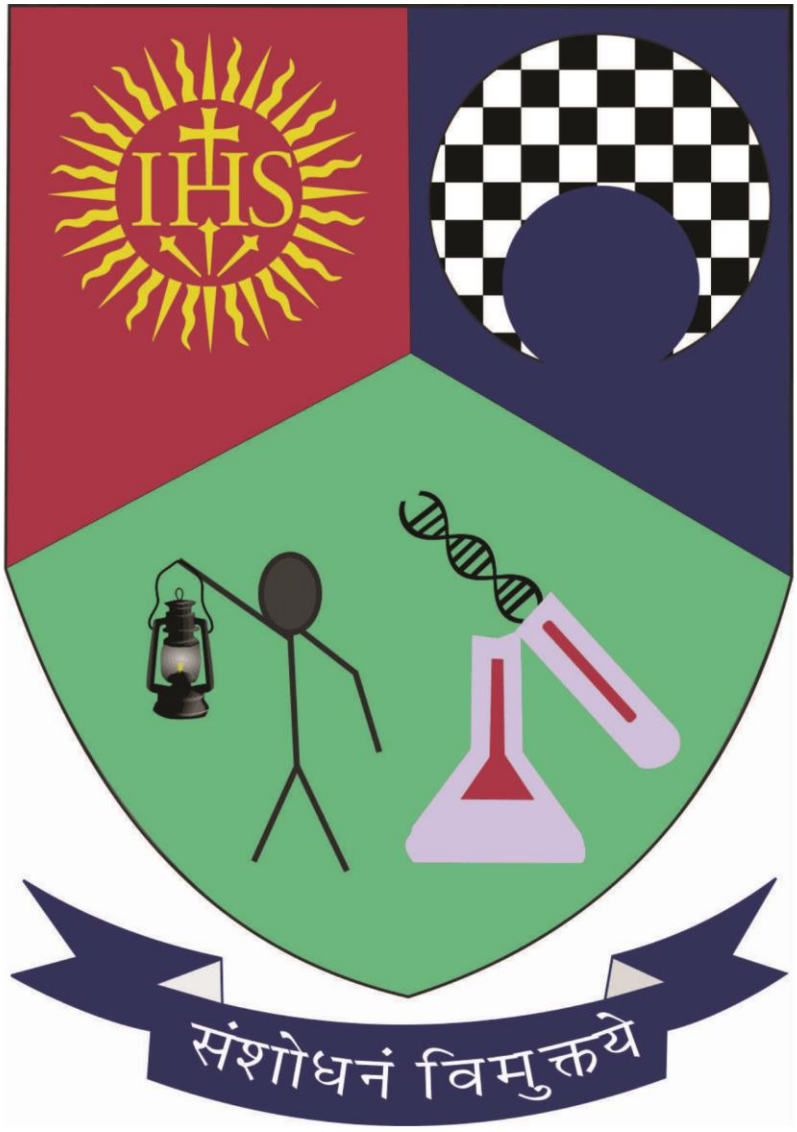
**of the Activities and Achievements of the**

## Loyola Centre for Research and Development

**1 April 2019 to 31 May 2020**

St. Xavier's College Campus,
Ahmedabad - 380 009.

www.xrf.res.in



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# 1. RESEARCH ACTIVITIES

## 1.1. On-going Scientific Research Projects

### *1.1.1. Completed/Ongoing Sponsored Scientific Research Projects:*

- A 9 months project **"Feasibility Study for Value Added Forest Products to Establish Sustainable Livelihood for Tribal Women Groups in Gujarat"** was sanctioned to the Xavier Research Foundation (XRF) by the Province Development Office (PDO), Gujarat Province in January 2019; and financed through the Province of Spain (ALBOAN).

  Based on the suggestions to make the feasibility study possible at a professional level, Mr. Vijay Parmar and Mr. Nabarun Gupta were brought on board as experts in the project. Dr. Mayur Panchal was appointed to the post of the Junior Scientist. Dr. (Fr.) Vincent Braganza was the Project Coordinator, and Ms. Shweta Wadhwa the Manager. Mr. Ankur Baruah was appointed to the post of the Marketing Executive, and Mr. Raymal Pagi to the post of the Social Entrepreneur. The Project Committee met every month, and participation was focussed in view of the stated goals of the feasibility study. Other experts like Dr. Aeshna Amin (Formulator, Ahmedabad), Mr. Kumar Abhishek (Marketing Executive/Social Entreprenuer, Delhi), Fr. Joel Prakash Noronha (Pune) and Dr. Supriya D'Souza (XINRM, Social Centre, Ahmednagar) were also invited for some of the meetings for their inputs, and added value through their professional contributions.

**Team Meetings with Invited Experts**

To create awareness about the economic importance of the mentioned three plants in the feasibility study i) *Madhuca longif*olia (used for the extraction of oil) ii) *Cassia tora* (mainly used for the preparation of gum in the industry) iii) *Curculigo orchioides* (an endangered plant having medicinal properties); the team visited Narukot, Bhiloda, Poshina and Dediapada to interact with the tribal women and brief them about the project, and also through interaction to find out about the livelihood pattern of the area. The women were made aware that the main objective was to create livelihood options for them without harming the forest, and at the same time conserving the depleting plant varieties. It was also explained how the project will help a community organization in establishing and running a business around minor forest produce.

| **Visits/Meetings** | **Date** | **No. of Participants** |
|---|---|---|
| Meeting at Narukot | 19-03-19 | 9 |
| Meeting at Netrang (Reliance Foundation) | 25-04-19 | 26 |
| Meeting at Dediapada | 25-04-19 | 30 |
| Narukot women visit at LCRD | 29-04-19 | 65 |
| Meeting at Poshina | 16-05-19 | 35 |
| LCRD staff visit at Medicinal and Aromatic Plant Research Dept. at Anand Agriculture Univ. (AAU) | 07-06-19 | 5 |
| Meeting at Bhloda | 19-06-19 | 50 |
| Netrang/Dediapada women visit at LCRD | 27-06-19 | 36 |
| Meeting at Narukot | 29-06-19 | 40 |
| Meeting at Narukot | 14-07-19 | 250 |
| Meeting at Dediapada | 05-08-19 | 15 |
| Training for agricultural practices at AAU (attended by women from Narukot & LCRD staff) | 07-08-19 to 09-08-19 | 25 + 4 |
| Poshina women visit at LCRD | 13-08-19 | 30 |
| Meeting at Narukot | 14-08-19 | 72 |
| Meeting (& survey) at Dediapada | 05-09-19 | 52 |
| Survey at Narokot (on edible oil consumption) | 13-09-19 | 50 |
| Meeting at Poshina | 18-09-19 | 37 |
| Meeting at Narukot | 25-09-19 | 89 |
| Bhiloda women visit at LCRD | 26-09-19 | 50 |

In a meeting with the women of the saving and credit society at Narukot, Dr. Braganza explained to them how transfer of technology would help them in running an enterprise and how it can economically uplift a good number of tribal families. Mr. Ankur and Mr. Raymal motivated the women by citing examples of successful entrepreneurship models of tribal women. The women leaders expressed their willingness to establish the enterprise and their preparedness and

commitment for the same. They also shared that all the three plants were available in their area in plenty.

**Clockwise from Top Left: Meetings with the women at (1) Bhiloda (2) Poshina (3) Narukot (4) Survey on the consumption pattern of edible oils (Dediapada)**

A meeting was also held at the office of Reliance Foundation in Narmada district, to brief the tribal women and sound them on possibilities. The staff members of Reliance Foundation were also present and actively participated in the meeting. The organization has a biodiversity wing and has good knowledge of local flora and fauna available in the area. Ms. Avni Rawal, Head of the Reliance Foundation Netrang unit was the link person between the project team and the community members. Tribal women from the neighbouring villages participated in the meeting. They were all shareholders of Farmers Producer Organization (FPO) and were carrying out business activities of different commodities and services to the farmers.

**Meeting at Reliance Foundation, Netrang**

In a meeting organized at the Dediapada village, Dr. Vincent offered Musli plantlets to all the women who had given mahua seeds and mentioned that they have to grow these plantlets in their backyards or agricultural land for long term benefits. The Musli plantlets were gifted to the women and they can sell the same plantlets after a year or two to get double benefits.


**Dediapada women with the Kali musli plantlets**

In June 2019, the Project team visited the Medicinal and Aromatic Plant Research Department at Anand Agriculture University (AAU), and met the Head Dr. H.L. Dhaduk. Dr. Dhaduk shared his knowledge and expertise about the cultivation of musli with the team. He also mentioned that they provided training in groups of 30 farmers (including men and women) free of cost.

**(Top) With Dr. H. L. Dhaduk at AAU, (Bottom) In the Inoculation Lab.**

Accordingly, a training for agricultural practices was organized by Xavier Research Foundation at Anand Agriculture University (AAU) at their Medical and Aromatic Plant Centre, from 7$^{th}$ to 9$^{th}$ August 2019. A total of 24 women and 1 man from Narukot came for the training. Dr. Mayur Panchal, Ms. Priya Vyas, Mr. Raymal Pagi and Mr. Jayesh Rathod joined the group for training

from XRF. Accommodation and food facility was provided by AAU. A kit containing seeds of medicinal plants were given to the Narukot group by AAU.


**Dr. (Fr.) Vincent Braganza & Ms. Shweta Wadhwa with the Narukot women at AAU**

During the 3 days, the women were given presentations about the identification, uses, and cultivation of medicinal plants. They were also given presentations on animal husbandry, how to prepare extracts from medical plants against swine flu, organic farming. The group was also taken for a field visit.


**The Narukot women at AAU during a presentation session**

Over the course of the feasibility study, several tribal women from Narukot, Dediapada, Poshina and Bhiloda visited our Centre to see the instruments and their working. The project team, including the two experts, interacted with them. As part of the interactions, the women agreed to collect Mahua seeds and make them available to LCRD for further purposes of the project.

**Clockwise from left: Women from Narukot, Dediapada, Poshina and Bhiloda visit LCRD**

***Madhuca longifolia* (Mahua):**

A pilot small scale mini oil expeller acquired for the project was first tested on groundnuts for oil extraction. Modifications in the machine were suggested for bigger size hopper which could reduce clogging of seeds in it.

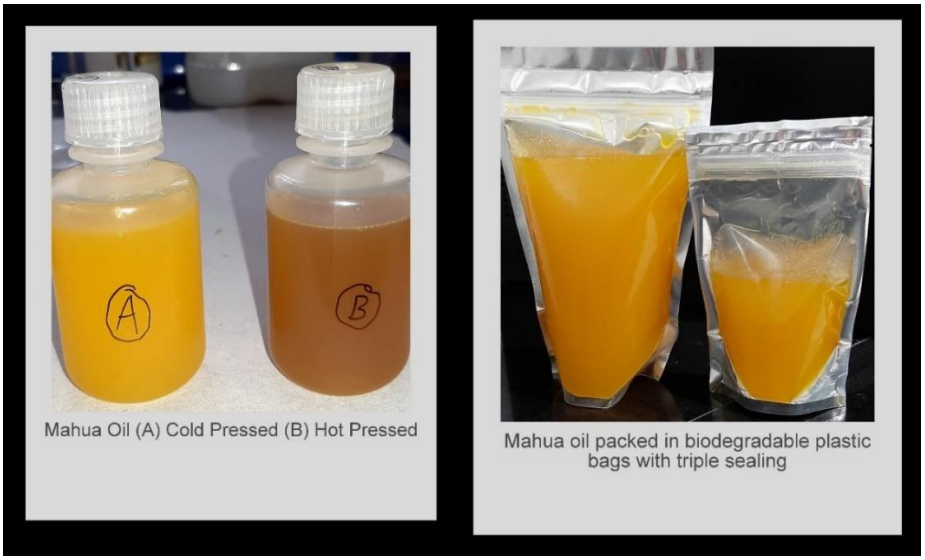
Mahua seeds (Mahuva Doli) from different villages (Bhiloda, Narukot, Netrang, Dediapada) were collected and processed for oil extraction. These seeds became available to us from the month of June 2019. Seeds were dried at different temperatures using hot air oven to check the variations in the nutritional components of mahua seed oil. Oil was extracted using cold pressed method to preserve the thermolabile components present in it. The deoiled seeds cake was directly applied in the coco peat grow bags as a fertilizer, to see the effect on Kali musli production.

**De-oiled Mahua seed cake**

The seeds could be acquired from the month of June to the month of August 2019, and hence further work to process, study their shelf life, preserve for long term, package extracted oil, etc. continues with the help of the scientist.


**Mahua seeds packed in biodegradable plastic bags containing Nitrogen, Carbon dioxide and Vacuum to check their shelf life**

Using the small customized oil expeller unit, oil was extracted from Mahua seeds through cold pressed and hot pressed method under standard operating conditions and checked for the fatty acids content in each type of oil processed. The oil was packed in food grade sample bags.




Through Gas Chromatographic analysis, the Fatty acid content in Hot and Cold pressed oil were analyzed and results were as given in the table below:

### Fatty acid components through Gas Chromatography

| Fatty Acids | Cold Pressed | Hot Pressed |
|---|---|---|
| **Palmitic Acid** | 21.08% | 22.09% |
| **Stearic Acid** | 23.69% | 20.35% |
| **Oleic Acid** | 37.44% | 41.34% |
| **Linoleic Acid** | 16.44% | 15.40% |
| **Linolenic Acid** | 0.67% | 0.56% |
| **Arachidic Acid** | 0.28% | 0.25% |
| **Lignoceric Acid** | 0.40% | NA |

***Cassia tora* (Powar):**

Seeds of *Cassia tora* were powdered using mixer grinder. The process of gum preparation was explored and literature for the same was accessed. However, in the continuing meetings of the Project team with the experts, a decisión was taken based on feedback from the field, not to venture in a serious way into this.

***Curculigo orchioides* (Kali Musli):**

Mass multiplication of Kali Musli continues on a regular basis in the growth room of Xplant enabling us to go in for year round plantlet production through plant tissue culture. Major modifications like paver block fitting, new water irrigation system etc. have been done in our Greenhouse. Now musli plantlets are ready to be given to the women in rural áreas, as we have successfully grown the plantlets in coco peat grow bags.

At the end of the project, **a feasibility report** was prepared by the two experts Mr Nabarun Gupta and Mr. Vijay Parmar, and they suggested next two years to consolidate the work that had been initiated at Narukot, with an existing women's collective to establish several oil extraction centers. They also suggested that the mechanism that is to be adopted will have to be piloted so as to establish a system that would run well. During this period from the Khol (by product) of the Mahua seeds, experimentations to develop a few products and sell the same in packaged form was recommended.

It was also mentioned in the report that the quality of Mahua oil being good and it being better in many ways in terms of its content for example good cholesterol etc., efforts to popularize the use of this oil in the rural areas should be made.

- A 2 years project titled **"Forest to Farming for Sustainable Livelihoods for Tribal Women in North Gujarat"** was sanctioned to the Xavier Research Foundation by the Jesuit Missions, UK in March 2019; to enable about 100 tribal farmers (mostly women) to grow plants propagated through plant tissue culture in the laboratories of the LCRD, in their fields or on their borders. The specific species involved is *Curculigo orchioides* (Kali Musli), a forest species of commercial value.

  Planning to enable the production of 3,00,000 plantlets was done with the scientific group at the LCRD (Dr. Mayur Panchal, Ms. Hita Rathore, Ms. Disha Patel, Ms. Priya Vyas, Ms. Riddhi Parmar and Ms. Priyanka Dube). Ms. Hita Rathore was designated as coordinator for the project. Various responsibilities for the different aspects of the production of the plantlet were assigned. Chemicals, glassware were acquired. Mid-June the move towards plantlet production was initiated. For the implementation of the project, mother plants

for converting to plant tissue culture were obtained from two forest areas, Dediapada and Narukot. Leaves (Explant) of the plants and also rhizomes were used in order to initiate the plantlets. The photographs below illustrate the various steps involved.


**(1) Media Preparation Lab (2) Leaves (Explant) taken from previous batch or from greenhouse, surface sterilized (3) Explant inoculation in liquid media (4) Bulbils growth started (5) Bulbil showing shoot and root**


**(1) Subculture on solid media, transferred to growth room for further growth**
**(2) Growth Room, bottles with sub-cultured plant kept on racks**
**(3) Well-developed roots (4)&(5) Transfer to Green House**

The project team also interacted with Prof. O.P. Saxena (Secretary NASI (Ahmedabad Chapter) and Rt. Prof. & Head, Botany Department, Gujarat University) to get a better understanding of the PTC techniques they were using for the production of Kali Musli plantlets.

**Project Team interacting with Prof. O.P. Saxena (Feb. 2020)**

Simultaneously meetings with the tribal women groups were also initiated in Poshina (Sabarkantha district), Bhiloda (Aravali district), Dediapada and Narukot (Panchmahal district).

- The women in all the four villages were briefed about the project and informed about the medicinal importance of Kali Musli. Many women were aware about Kali Musli, and they had been harvesting it from the forest in the past.
- Dr. Mayur explained the method of growing Kali Musli by using tissue culture technology and how the plant can be cultivated in the farmlands, without walking long distances in the forests. The women expressed their interest for growing the plant in their farmland, and around their homes.
- The tribal people in the area are struggling for livelihood and are unable to find employment as the areas are socioeconomically backward. There are still opportunities in forest and agriculture that can provide sustainable livelihood. Demand for herbal medicine is rising and in this context the project holds promise to create a good livelihood opportunity for the women farmers.

Trips were also made to various forest areas for source material towards generation and multiplication of plantlets.

**Clockwise from left: Meetings with the tribal women farmers of Poshina, Bhiloda & Narukot**

Transfer from the laboratory to the Greenhouse to the field on a repeatable basis has been achieved. Comparative study of the survival and the growth of the tissue cultured plants and the naturally growing plants brought from the Dediapada and Narukot forest area in the fields were carried out in different locations. Cultivation when done in soil enriched with cow dung manure and in soil with vermicomposting showed less and slow growth of primary and secondary roots in comparison to the soilless cultivation in plastic bags filled with coco-peat and supplemented with NPK. Based on these findings, renovation of our Greenhouse with automated drip irrigation system has been done. The Greenhouse has been redesigned and modified for a floor capacity of 7000-10000 plantlets. Designing for a three-tier system to achieve a capacity of 30000 plantlets has been undertaken.

**The Project Team involved in Kali Musli Production**

**Planting of Kali musli**

**L to R: (1) Kali musli in Green House (2) Flowering Kali musli in Green House (3) Kali musli in field**

### *1.1.2. New Sponsored Scientific Research Project:*

Based on the feasibility study report for value added products, in January 2020 the PDO-ALBOAN approved a 9 months **"Pilot Project for Oil Extraction and Shea butter equivalent towards Market for Sustainable Livelihood for Tribal Women"** to LCRD, in **Narukot**. Dr. Mayur Panchal continued as the scientist in the pilot project, and Sr. Vandana from Jivan Vikas Kendra (JVK) Narukot joined as the Social Entrepreneur.

The project was initiated at field level in Narukot with the first visit on 29th January. Two more trips were made in February and March respectively. The trips were organized to bring together the women, and to follow up on the feasibility study towards implementation through production of oil and shea butter equivalent for livelihood earning, from the Mahua doli (seeds). The goals of these meetings were to impart information about the project and to start the process to select the women (about 40 to 50 in number), and to motivate them to commit to collecting the doli and participate in the production. All the women that attended these meetings had earlier contact with the LCRD team during the feasibility study, hence rapport was smooth. Each of them had membership in the women's cooperative Jivan Vikas Kendra (JVK) run by the Narukot sisters.

**Meeting with the sisters at JVK, Narukot**

**Meeting with the Narukot women**

Places and points for storage of doli once they would be acquired and a place for setting up production were explored and considered on the Narukot campus. Tables and stools for the production place were acquired from a local carpenter at Jambugodha. At LCRD, the steps to acquire a microenterprise scale set of oil expeller machines and solar dryers were begun. Shelf life studies on the doli and its oil from the feasibility study were continued and the data analyzed and stored.

The local home wooden oil extractor was tracked down to a family; two pieces locally produced were acquired and three pieces were commissioned in Ahmedabad. A total of 5 pieces are now available with us for manual extraction of cold pressed oil, for use in the cosmetic industry. Most families no longer have this device, as they prefer to go to the 'Ghani' to extract oil for family consumption. Women will have to be retrained by the few women who know how to do it.

**Local Home Wooden Oil Extraction Devices at Narukot**

During the Lockdown, for the entire period the LCRD as per Government injunction had to stay closed from 25th March to the last week of May 2020. Over this time the labs and experiments that had been initiated could not be attended to. Instruments like shakers etc. and plant tissue culture requiring reagent changes suffered major damage and we suffered losses as a result of instrument damage, loss of precious organisms and chemicals. At Narukot the boarding and school was shut down and all social work activity was closed.

**All our staff has stayed safe and in good health. However, we estimate that the losses that we have incurred translate in monetary terms to about 25 Lakhs.**

### *1.1.3. Ongoing Ph.D. Projects:*

As a part of our vision and commitment to promote innovation and excellence in research, LCRD supports research scholars by providing them not only infrastructure to pursue their Doctor of Philosophy (Ph.D.) degree, in several cases their research programmes are also funded by the Xavier Research Foundation (which administers the Loyola Centre for Research and Development). Besides, they have access to our library that subscribes to several national and international journals.

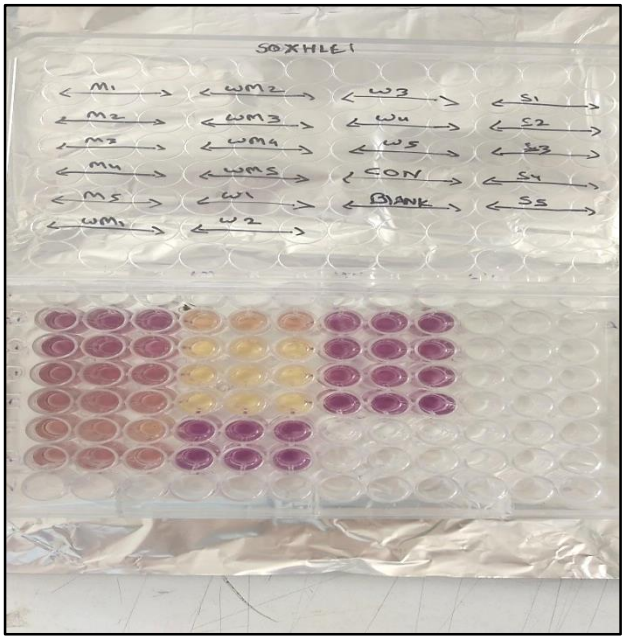
All Ph.D. scholars' research programmes are guided/co-guided and supervised by the Director of LCRD. The collaboration with various mentors and guides that this has enabled, has expanded the research network of LCRD.

| Research Scholar | Research Project | University |
|---|---|---|
| Ms. Priya Vyas<br>Field of Research: Biochemistry<br>***(Thesis submitted. Awaits defense)*** | Studies on the chemotherapeutic potential of some medicinal plants using cell lines, *C. elegans* and Swiss Albino Mice as testing models for lung/breast cancer. | Gujarat University<br>*Guide:* Dr. (Fr.) Vincent Braganza |
| Ms. Riddhi Parmar<br>Field of Research: Zoology | Studies on the effects of selected plant extracts in relation to stress, memory and ageing using *Caenorhabditis elegans* model. | Gujarat University<br>*Guide*: Dr. Hyacinth Highland<br>*Co-Guide:* Dr. (Fr.) Vincent Braganza |
| Ms. Priyanka Dube<br>Field of Research: Biochemistry | Influence of extracts from selected medicinally important plants on *C. elegans* in terms of regularizing metabolism and stress. | Gujarat University<br>*Guide:* Dr. Nayan Jain<br>*Co-Guide:* Dr. (Fr.) Vincent Braganza |
| Mr. John D'Costa<br>Field of Research: Forensic Environmental Chemistry | Environmental audit of the Pirana landfill of Ahmedabad. | Gujarat Forensic Sciences University<br>*Guide:* Dr. Harshad Patel<br>*Co-Guide:* Dr. (Fr.) Vincent Braganza |
| Ms. Saeida Saadat<br>Field of Research: Bio nanotechnology | Development of Halloysite nanotubes based antimicrobial nanocomposites for myriad applications. | Gujarat Forensic Sciences University<br>*Guide:* Dr. Deepak Rawtani<br>*Co-Guide:* Dr. (Fr.) Vincent Braganza |

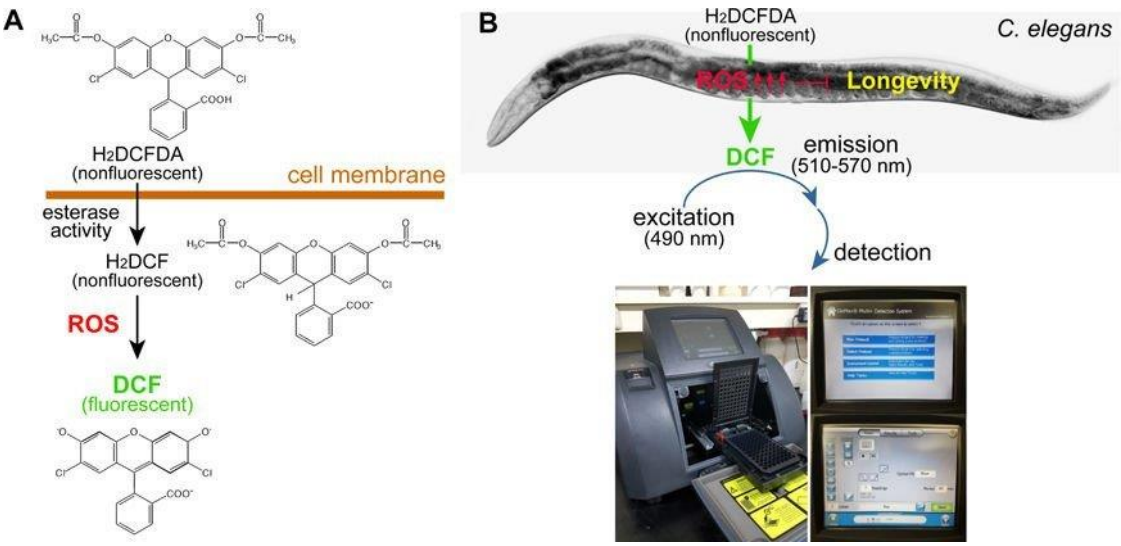
## Brief Overview of a few Ongoing Theses:

i) Studies on the effects of selected plant extracts in relation to stress, memory and ageing using *Caenorhabditis elegans* model.

The investigation is aimed at evaluating the antioxidative and stress resistance efficacy of *Bryophyllum pinnatum* extracts (BP) using *Caenorhabditis elegans* (*C. Elegans*) as the experimental model. The antioxidant activity of the BP extract was evaluated *in vitro* (DPPH[3], reducing power and total polyphenol content) and *in vivo* (DCF-DA assay). Different pharmacological doses of BP crude extract i.e. 1mg/ml, 10mg/ml and 100mg/ml were used to determine dose dependent impact on lifespan, thermotolerance (37°C) and ROS scavenging activity (20 mM $H_2O_2$), and standard Health span parameters viz. pharyngeal pumping and body bent. The study revealed that BP-hydromethanolic extract possess significant *in vitro* and *in vivo* antioxidant activities which possibly contributed to its role in enhanced stress tolerance. The extracts also proved effective in increasing the mean lifespan of *C. elegans* following exposure to thermal and oxidative stress. Further BP treated worms showed better pharyngeal pumping and body bent rate compared to untreated animals. The study strongly suggests that the *B. pinnatum* extract acts as an effective anti-stress agent and potent scavenger of reactive oxygen species, which consequently enhances the survival of the worms in different stress conditions.




**DPPH Assay Results**




**DCF-DA Assay**

ii) Influence of extracts from selected medicinally important plants on *C. elegans* in terms of regularizing metabolism and stress.

Herbal drugs are used for the treatment of diseases and disorders because of their advantages of less side effects, easy availability and low cost. In the current study, several bioactive compounds were selected from the medicinal plants based on literature survey for screening. The aim and objective of the study is to perform *in-silico* docking analysis of the bioactive constituents identified in Indian medicinal plants for anti-diabetic activity. The targets for anti-diabetic activity are Insulin receptor, Glucagon receptor and some transcriptional factors. The X-Ray crystal structure of target was retrieved from protein data bank in .pdb format. The phytoconstituents of the medicinal plants were retrieved from PubChem compound database in .mol format. *In-silico* docking analysis was performed by using Schrödinger software. During the analysis several potential bioactive compounds (like gossypetin, herbacetin, kaempferol, leucoperalgonidin, leucodelphinidin and sorbifolin) were successfully identified on the basis of binding energy.

iii) Environmental audit of the Pirana landfill of Ahmedabad.

The study intends to evaluate the environmental impact of Pirana Landfill, and is based on air, water and soil analysis. It is an accepted fact that uncontrolled dumping of waste on precious land in and around towns has created a major source of contamination of air, water and soil of that area. India recognizes the dual benefits that can arise from efficient waste disposal, leading to enhanced environmental benefits along with conversion of waste to energy.

During this study, the ambient air quality samples were collected from Pirana as per standard norms for ambient air quality monitoring. The parameters determined during analysis included PM10, PM2.5, So2 and Nox. The data collected was

compared to the standards set up by the National Air Quality Monitoring Program (NAMP).

Water samples collected at Pirana were sent to SICART, Vallabh Vidhyanagar for ICP analysis. One batch of samples were analyzed at Gujarat Forensic Sciences University (GFSU) Gandhinagar, and the results compiled. Both the samples were studied for TDS, Nitrates, Iodine Fluorides and Chromium.

Soil samples have been sent to SICART, Vallabh Vidhyanagar and also tested at GFSU for Ph, organic carbon, available nitrogen, available phosphorus, heavy metals and essential micronutrients.

**(L) Sample collection at Pirana (R) PM 2.5 sampling carried out at Pirana**

### *1.1.4. Ongoing In-House Scientific Research Projects:*

As we move towards our goals of equal and sustainable societies, several in-house scientific research and development programs are being carried out at our Centre focused on our mission vision values.

All the scientific research at LCRD is overseen by Dr. (Fr.) Vincent Braganza, Dr. S.R. Dave and Dr. S.K. Ghosh. Each continues to be recognized at international, national and regional fora and levels. All research publications are reviewed for intactness of language by Ms. Shweta Wadhwa.

*A few of the ongoing in-house projects are:*

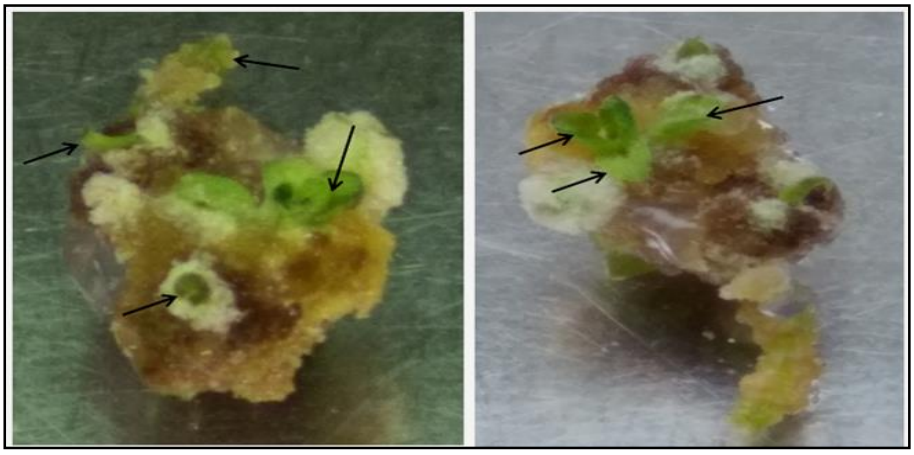
- Growth Induction from *Stevia rebaudiana* Bertoni leaves.

  *Stevia rebaudiana* Bertoni (natural sweetener) belongs to Asteraceae family and can be used as a substitute for artificial sweeteners for diabetic patients. Conventionally, it is cultivated by seeds or stem cutting, but seed viability rate is poor. Thus a protocol for induction and multiplication in short incubation period from the *Stevia* leaf explant was developed in our labs. Surface sterilized leaf explants were cultured on Murashige and Skoog (MS) mediums with different concentrations of plant hormones in various combinations. In one of our hormonal combinations, we produced 100% results from leaf explant cultures within two to three weeks of incubation. We have also standardized the protocol for the plantlets regeneration from *Stevia* wherein large sized leaves were obtained after 2 weeks of inoculation, and the sterile leaves of these regenerated plantlets were used for future experiments in our standardized induction nutrient medium. It was also found that in the presence of a specific concentration of hormones (PGRs), the growth obtained from leaf explants were of different colours viz. Soft and Creamy, Shiny Green, Hard and Brown and Thick Black. However, the prolonged incubation of green tissues also turned light to dark brown within 3-4 weeks on the same medium. The present findings deal with the induction of *Stevia* and its various stages of rapid multiplication for study of steviol glycosides.

**Various stages of micropropagation of *Stevia rebaudiana* Bertoni**


**Change in the colouration on prolonged incubation (beyond 2 weeks)**

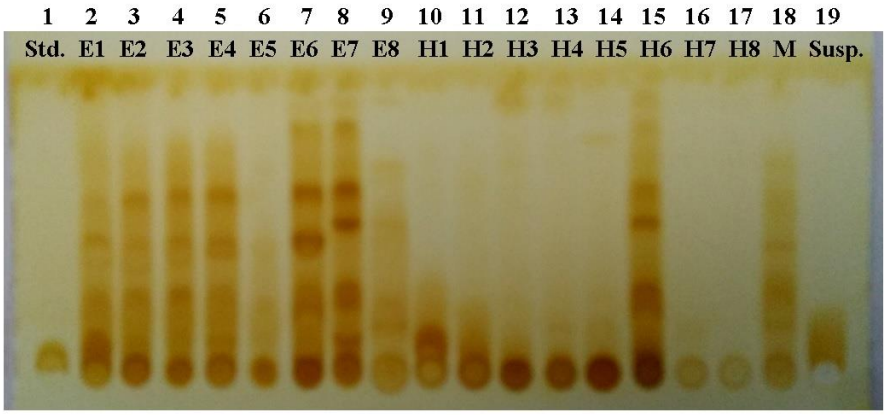
The somatic embryoids were also induced for developing artificial seeds in the future. The plant producing efficiency and rate of survival of the produced embryoids was checked. There were about 70% efficient embryoids developed into healthy *Stevia* plantlets on the MS medium with hormones.



**Somatic embryogenesis (Arrows shows the embryoids developed)**

**Development of plantlets from the somatic embryoids**

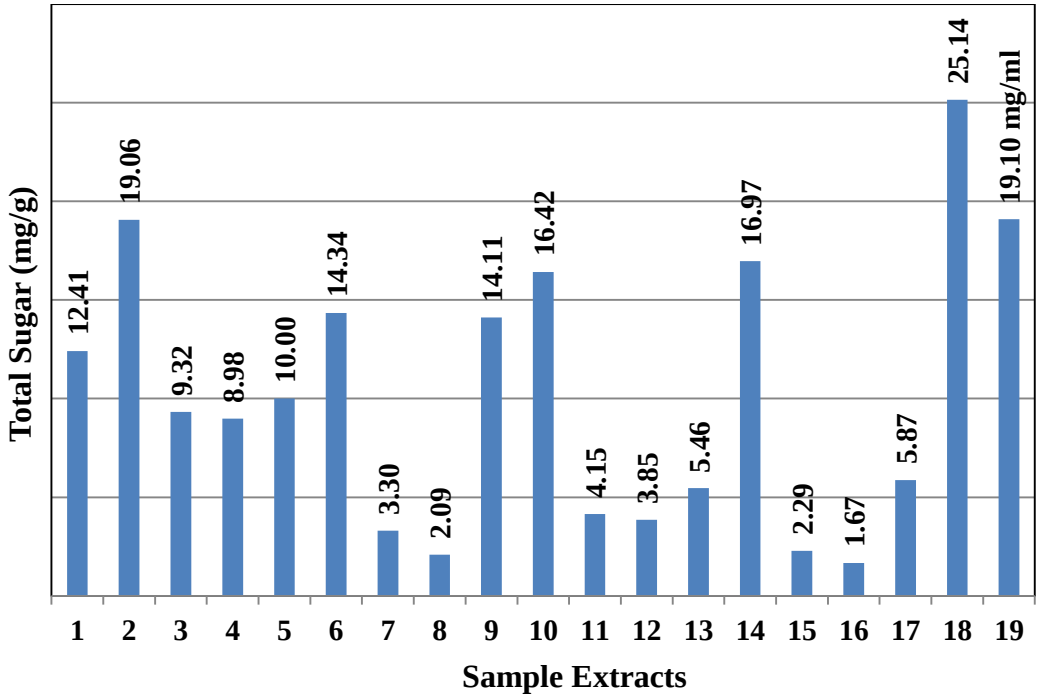
Since four different coloured cell masses *in vitro* were produced, all of them were used to assay the biochemical composition along with *in vitro* and *in vivo Stevia* leaves. Two weeks old cell mass was inoculated into suspension medium without any hormone supplement and allowed to incubate on agitation. After 15 to 20 days, it was observed that with almost 10% increase in size of the suspended green cell mass, it turned light brown in colour and the suspension medium became slightly viscous with pale yellow colouration. The 20 days old suspension medium was also used for the biochemical assay. TLC assay of ethanol and aqueous extracts of different cell mass, *in vitro* and *in vivo* leaves of *Stevia* and 20 days old suspension medium from suspended green cell mass is shown in the figure below. Different band patterns were observed in almost all samples. Few of the samples did not show any band. We are in the process of optimizing a suitable extraction method and mobile phase to get maximum bands in all the samples, and to determine the specific compounds with the help of an appropriate Rf value in each of the extracts.




**TLC assay of ethanol and aqueous extracts of different cell mass derived from leaf explants and *in vitro* & *in vivo* leaves of *S. rebaudiana* (Sample names of the labels are mentioned in Table below)**

**Extract Samples of *S. rebaudiana* and experimental *in vitro* products (EIVP)**

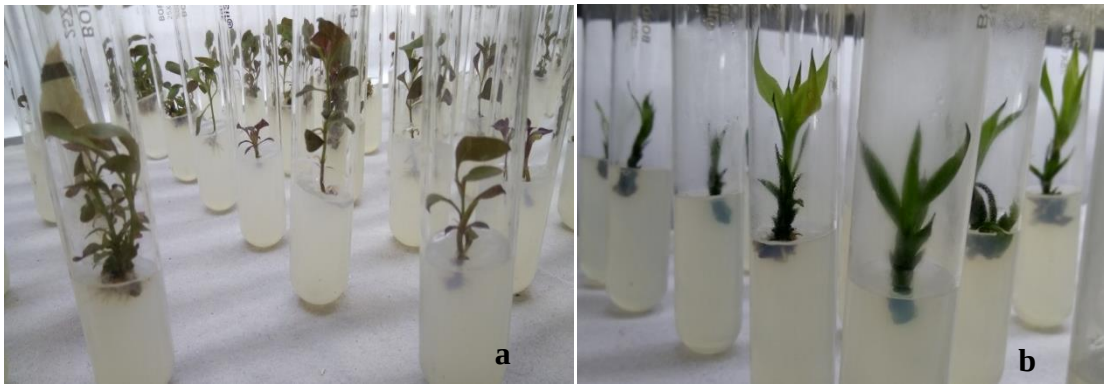
| S. No. | Labels | Samples |
|---|---|---|
| 1 | Std | 50 µg conc. Aqueous sugar-free (1 mg/ml) |
| 2 | E1 | Ethanol extract of dried creamy EIVP |
| 3 | E2 | Ethanol extract of dry brown EIVP |
| 4 | E3 | Ethanol extract of dry green EIVP |
| 5 | E4 | Ethanol extract of dry black EIVP |
| 6 | E5 | Ethanol extract of dry *in-vitro* leave powder |
| 7 | E6 | Ethanol extract of dry *in-vivo* leave powder |
| 8 | E7 | Ethanol extract of *fresh in-vitro* leave powder |
| 9 | E8 | Ethanol extract of fresh *in-vitro* green EIVP |
| 10 | H1 | Aqueous extract of dry creamy EIVP |
| 11 | H2 | Aqueous extract of dry brown EIVP |
| 12 | H3 | Aqueous extract of dry green EIVP |
| 13 | H4 | Aqueous extract of dry black EIVP |
| 14 | H5 | Aqueous extract of dry *in-vitro* leave powder |
| 15 | H6 | Aqueous extract of dry *in-vivo* leave powder |
| 16 | H7 | Aqueous extract of fresh *in-vitro* leave powder |
| 17 | H8 | Aqueous extract of fresh *in-vitro* green EIVP |
| 18 | M | Methanol extract of fresh green EIVP |
| 19 | Susp. | 20 days old suspension of green EIVP |




**Estimation of total sugar of different EIVP derived from leaf explants and *in vitro* & *in vivo* leaves of *S. rebaudiana***

- Micropropagation of four plants viz. Indian barberry (*Berberis aristata*), two cactus species (*Melacactus curvispinum and Mammillaria schiedeana*) and Lucky bamboo (*Dracaena braunii*) for commercial purpose.

  In-house PTC multiplication/production of the four plants viz. Indian barberry (*Berberis aristata*), two cactus species (*Melacactus curvispinum and Mammillaria schiedeana*) and Lucky bamboo (*Dracaena braunii)* continues, for creating miniature ornamental plants in colourful and soil free medium; specially meant to survive without watering. These plants come in customized stands, decorative test tubes and earthern pots, and are a part of the initiative of XPlant, the entrepreneurial venture of XRF.




**Micropropagation of (a) *Berberis aristata*) (b) *Dracaena braunii***


**(c) Micropropagation of *Melacactus curvispinum and Mammillaria schiedeana* for commercial purpose**

- Preparation of herbarium sheet of *Curculigo orchioides.*

## 1.2. Scientific Research Projects Submitted for Financial Assistance

Submitted to Government of India, Ministry of Science and Technology, Department of Science and Technology, Science for Equity Empowerment and Development (SEED) Division, Scheme "STI Hub for ST Community":

| Project Coordinator | Title of the Proposal | Project Cost (in INR) |
|---|---|---|
| PI:<br>Dr. Sudha Sahay<br><br>Co-investigators:<br>Dr. (Fr.) Vincent Braganza and Dr. Shailesh R Dave | Science technology and innovation hub for the propagation of endangered ethno-medicinal plants at Bhiloda taluka, North Gujarat by involving local tribal communities | 1,11,99,200 |

Submitted to Biotechnology Industry Research Assistance Council (BIRAC), New Delhi:

| Project Coordinator | Title of the Proposal | Project Cost (in INR) |
|---|---|---|
| Dr. Sudha Sahay<br><br>Team Members:<br>Dr. (Fr.) Vincent Braganza and Dr. Sushma Shah<br><br>Scientific Advisor:<br>Dr Shailesh R Dave | Suspension cultures for production of aphrodisiac plus energy enhancer formulation. (A TECHNOLOGY AVAILABLE FOR COMMERCIALIZATION) | 49,94,000 |

Besides, the scientific proposal "Development of Microbial consortia for the treatment of industrial waste with high TDS, color and organic pollutants" submitted by the Xavier Research Foundation in collaboration with Jay Chemical Industries; to Department of Science and Technology (DST) (GoI) in 2018-19, is under consideration under Technology Missions Division and Optimal Water Use in Industrial Sector Scheme, as per a mail received from DST on 13th May 2020, and we look forward to its approval.

## 1.3. Workshops and Training/Lectures

The Management at XRF recognize the importance of continued education and training of the staff through workshops and symposiums, so that the staff continues to develop skills and also takes this opportunity to meet other members in their field, exchanging insights and viewpoints and further broadening their horizons. In view of this, the staff attended several symposiums/conferences/workshops/trainings during the year, and were also encouraged to attend webinars while staying isolated at home during the Coronavirus lockdown period. A few of them are listed below:

- A talk on "Tossing Coins Inside Living Cells" by Prof. Roop Mallik, a Professor in the Department of Biological Sciences at Tata Institute of Fundamental Research (TIFR), Mumbai and winner of the 2018 Infosys Prize in Life Sciences, on 20th June 2019 at IIT Gandhinagar.
- Conference on "Enhancing Competitiveness in MSMEs" organized by FICCI (Federation of Indian Chambers of Commerce and Industry) and iNDEXTb (Industrial Extension Bureau, a Govt. of Gujarat organization) on 21st August 2019 at the Hyatt Regency, Ahmedabad.
- Workshop on "Proteomics Workflow - Sample Preparations to Sequencing" on 29th – 30th August 2019, organized by Department of Zoology, Biomedical Technology & Human Genetics (Gujarat University), Wild Life Biology and Conservation in association with BIO –RAD.

- Seminar on "Curious mind programme" organized by Merck Life Science at IIT Gandhinagar on 21st September 2019.
- International Conference on Biomolecular and Biotechnological Aspects of Medicinal Plants, 18th – 19th October 2019, organized by L. M. College of Pharmacy at the Ahmedabad Management Association.
- Skill-building workshop on "Master the Publishing Process!" organized by the American Chemical Society (ACS) and the Department of Science & Technology (DST), Govt. of India in association with Vigyan Prasar on 15th November 2019 at CSIR-Central Salt & Marine Chemicals Research Institute, Bhavnagar.
- Training programme on "Application of Real Time PCR" organized by Kamdhenu University & Gujarat Biotechnology Research Centre (GBRC) at GBRC, Gandhinagar from 25th – 29th November 2019.
- Dr. Radium Bhattacharya Memorial Lecture on 15th December 2019, organized by Gujarat AIDS Awareness and Prevention Unit of ISRCDE (GAP-ISRCDE) at Sports Club, Navarangpura, Ahmedabad. *Dr. S.K. Ghosh is the General Secretary of GAP-ISRCDE*.
- CII Packaging Summit (Packaging Prospects: Driving Changes to Multiply Growth) organized by the Confederation of Indian Industry (CII) on 18th December 2019 at Holiday Inn, Mayur Vihar, New Delhi.
- The "National Seminar on Present Day Biology" organized by the Department of Biochemistry and Biotechnology, St. Xavier's College Ahmedabad on 3rd - 4th January, 2020.
- A training programme on "Good Clinical Laboratory Practice" at Translational Health Science and Technology Institute (THSTI), NCR Biotech Science Cluster, Faridabad on 30th - 31st January 2020; organized by Clinical Development Services Agency (CDSA), Faridabad and Biotech Consortium India Limited (BCIL), and supported by National Biopharma Mission (NBM).
- The "National Symposium on Trends in Plant Biotechnology & Agriculture" and 41st Annual Meeting of Plant Tissue Culture Association of India from 6th – 8th February 2020, at Thapar Institute of Engineering & Technology, Patiala, Punjab.
- International Seminar on "Intellectual Property Rights - Branding & Patent @ Local & Global" organized by Markpatent.Org at Renaissance by Marriott Ahmedabad on 8th – 9th February 2020. *LCRD was one of the co-organizers for the event*.
- Seminar on "Diabetes A TO Z" organized by the National Academy of Science (Ahmedabad Chapter) and Dept. of Zoology, Biomedical Technology & Human Genetics, Gujarat University, Ahmedabad on 15th February 2020.
- An ecology workshop on "Towards an Apostolic Platform of Ecology" of the Jesuit West zone of South Asia at the Pastoral Centre, Nadiad from 21st – 23rd February 2020.
- "Training on Waste Management Rules and Their Amendments", organized by Confederation of Indian Industry and CII-ITC Centre of Excellence for Sustainable Development, on 6th March 2020.
- Webinar on "What is required for a successful research proposal!" organized by School of Sciences, P. P. Savani University, Surat on 2nd May 2020.

- Webinar on 5th Bio-Rad ddPCR Asia Pacific Virtual Symposium (Week-1:COVID-19 Detection) on 6th May 2020.
- Webinar on "Genome Sequencing in Search for Vaccine for Coronavirus" organized by Gujarat Biotechnology Research Centre (GBRC), Department of Science and Technology, Govt. of Gujarat on 13th May, 2020.
- Webinars on "Coronavirus lockdown: Effects on seismic noise and seismicity" and "Protecting from Corona: Innovative approaches and solution" organized by the National Council for Science and Technology Communication, Dept. of Science and Technology, Govt. of India and Gujarat Council on Science and Technology, Dept. of Science and Technology, Govt. of Gujarat on 14th May 2020 and 16th May 2020 respectively.
- Webinar on "S&T intervention in fighting COVID19 pandemic" organized by Gujarat Biotechnology Research Centre (GBRC), Dept. of Science and Technology, Govt. of Gujarat on 15th May, 2020.
- Webinar on "Be COVID Wise, Know about COVID in Gujarati" by ISRC-Indian Scientist response to Covid-19 on 29th May, 2020. *Dr. Mehraab Modi, a past research student, was one of the main anchors.*
- Webinar on "GC, GCMS & GCMSMS – Basics & Principles" and "Liquid Chromatography Mass Spectrometry – Basics & Principles" organized by Thermo Fisher Scientific on 29th May 2020.

# 2. LIST OF PUBLICATIONS

## 2.1 Manuscripts Published

The research staff and research scholars at XRF-LCRD are encouraged to do ethical and responsible research, and publish their work in peer-reviewed journals without fabrication, falsification or data manipulation. Following are the papers published from the period April 2019 to May 2020:

- Kinjal Desai, Vincent Braganza
  **Comparative Analysis of Cytotoxic Potential of Crude Extracts and Fractionated Isolates from *Moringa oleifera* Lam.**
  Advances in Plant & Microbial Biotechnology (Springer, Singapore), pp 59-68, April 2019. ISBN 978-981-13-6320-7, ISBN 978-981-13-6321-4 (eBook).

  ***Abstract:*** According to World Health Organization, most of the world's population depends upon plants as an important element in primary healthcare systems. Ayurveda is India's oldest indigenous medicine system of plant drugs. It is known for preventing or suppressing various tumors using natural drugs, one such being *Moringa oleifera* Lam. This plant has reported antioxidant properties for both fruits and leaves (Luqman S, Srivastava S, Kumar R, Maurya AK, Chanda D, Evid Based Complement Alternat Med 2012 (December): e519084. https://doi.org/10.1155/2012/519084, 2011); moreover, its extracts have exhibited anticancer properties *in vitro* in case of hepatocarcinoma as well as antitumor-

promoting activities for skin cancer in rat models (Guevara AP, Vargas C, Sakurai H, Fujiwara Y, Hashimoto K, Maoka T, Kozuka M, Ito Y, Tokuda H, Nishino H, Mutat Res/Genet Toxicol Environ Mutagen 440(2):181–188. https://doi.org/10.1016/S1383-5718(99)00025-X, 1999). The aim of this study is to investigate the antiproliferative activity of various extracts from *Moringa oleifera* Lam. and isolate the active compounds. Fifteen extracts were prepared form dried leaves of *Moringa oleifera* Lam. using five solvent systems and three methods of extraction. *In vitro* screening was done using *Schizosaccharomyces pombe* and MCF-7 cell line. The fractionation of active crude extracts was performed by silica gel column chromatography and fractions evaluated for cytotoxicity. The aqueous, methanolic and hydromethanolic extracts exhibited cytotoxicity against MCF-7 cell line at lower concentrations compared to lymphocytes. Our findings showed the following: (a) the crude extracts of *Moringa oleifera* Lam. exhibited cytotoxic potential; (b) the extracts were selectively more toxic to tumor cell line compared to normal lymphocytes; (c) The crude extract showed better anti-proliferative activity compared to fraction separated. The reason could be that the compounds in crude extract have a synergistic effect resulting in better activity.

- Priya Vyas, Vincent J. Braganza
  **Effect of solvents and extraction methods on the phenolic content, flavonoid content, and antioxidant activity of and *Bauhinia variegata* and *Leptadenia reticulate*.**
  Asian Journal of Pharmacy and Pharmacology 2019; 5(4): pp 834-840.

  ***Abstract:*** In the present study, we investigated the total phenolic content, total flavonoid content and antioxidant activity of the crude extracts of *Bauhinia variegata* and *Leptadenia reticulata*. The extracts were prepared using three experimental conditions [elevated and 25°C temperature; ultrasound vibrations] and four solvent systems [water, methanol, water: methanol (1:1), chloroform: methanol (1:1)]. The total phenolic content was estimated by the Folin-Ciocalteu method; total flavonoids was estimated by AlCl method; antioxidant activity was 3 determined using DPPH and phosphomolybdenum assay. For *Bauhinia variegata*, the methanol extract prepared at 25°C showed highest phenolic content (69.39 ± 1.22 mg GAE/g of dry extract), flavonoid content (44.50 ± 1.11 mg RE/g of dry extract) and free radical scavenging capacity (57.01 ± 1.57%) and methanol extract prepared at elevated temperature showed highest total antioxidant capacity (135.24 ± 4.37 mg AAE/g of dry extract). For *Leptadenia reticulata*, the water: methanol extract showed highest phenolic content (24.60 ± 0.65 mg GAE/g of dry extract), flavonoid content (6.44 ± 0.21 mg RE/g of dry extract) and free radical scavenging capacity (66.83 ± 0.91%) and methanol extract prepared by sonication showed highest total antioxidant capacity (52.88 ± 1.34 mg AAE/g of dry extract). These results indicate that these medicinal plants may have potential application in reducing oxidative stress due to presence of strong antioxidant activity. Further isolation and identification of bioactive component from these plants could have application in health and pharmaceutical industry.

- P.A. Vyas, V.J. Braganza
  **A Fission Yeast Bioassay for Rapid Screening for Antiproliferative Agents from *Bauhinia variegata* and *Leptadenia reticulate*.**
  International Journal of Pharmaceutical Sciences and Drug Research 2019; 11(6): 405-408. ISSN: 0975-248X, CODEN (USA): IJPSPP.

  ***Abstract:*** The aim of the present study was to evaluate the antiproliferative activity of crude extracts from leaves of *Bauhinia variegata* and *Leptadenia reticulat*a using fission yeast *Schizosaccharomyces pombe* as a model. The crude extracts of both plants were prepared by three experimental conditions (25°C, elevated temperature and ultrasound waves) and four solvent systems [Water, Methanol, Water: Methanol (1:1) and Chloroform: Methanol (1:1)]. MTT assay was performed for estimating the cell viability and the results were expressed as % growth inhibition. Overall based on the MTT assay performed on yeast cells, Water: Methanol, Methanol and Water extracts showed higher antiproliferative activity than the positive control (Paclitaxel) in a dose-dependent manner. For *Bauhinia variegata* and *Leptadenia reticulata*, methanol extract (25°C temperature & elevated temperature, respectively) exhibited highest inhibition which was approximately 80%. In conclusion, this study has indicated that *Bauhinia variegata* and *Leptadenia reticulata* extracts possess strong antiproliferative activity. Furthermore, it could act as a potential source for identifying new molecules with chemotherapeutic potential against cancer.

- Saeida Saadat, Gaurav Pandey, Maithri Tharmavaram, Vincent Braganza, Deepak Rawtani
  **Nano-interfacial decoration of Halloysite Nanotubes for the development of antimicrobial nanocomposites.**
  Advances in Colloid and Interface Science; 0001-8686/©2019 Elsevier B.V.A.

  ***Abstract:*** In recent times, incorporation of Halloysite Nanotubes (HNTs) with various antimicrobial agents as interfacial materials between these nanotubes and pathogenic microorganisms, for the development of antimicrobial nanocomposites with enhanced antimicrobial activities has gained researcher's interest. The main benefits given by HNT to these nanocomposites include enhanced thermal and mechanical stability of the antimicrobial nanocomposites and also prolong durability and release of the antimicrobial agents in a sustained manner. The exceptional structure of these aluminosilicate minerals based nanotubes (hollow tubular lumen with huge surface area) and oppositely charged surface molecules assist in attaching various molecules on both, the internal surface as well as on the outer surface of these nanotubes. Other advantages of these clay-based minerals are their biocompatibility, non-toxicity, eco-friendly nature and their natural availability with affordable price, which also contribute in selecting them as supporting material for biological applications. Therefore, these clay-based nanotubes have been recently used for developing various antimicrobial nanocomposites. In this review, various antimicrobial nanocomposites developed through incorporation of HNT with myriad antimicrobial agents such as nanoparticles, metal ions, antibiotics, essential oils, biopolymers, phenolic compounds, surfactants and food preservatives as an interface between these nanotubes and microorganisms have been discussed. These antimicrobial nanocomposites could be

synthesized in different forms (powder, film, nanocapsule and adhesive) which can be applicable in various fields such as food packaging, water decontamination, waste water management, healing of wounds, antimicrobial agents for surfaces, orthopedics and for the treatment of microbial infections.

- Shital Doshi, Vincent Braganza
  **Longevity promoting effect of *Catharanthus roseus (L.) G. Don* in *C. elegans* is modulated by daf-16 and other genes.**
  Biotechnology and Biological Sciences ((@2020 Taylor & Francis Group, London, UK. Page 417-426. ISBN 978-0-367-43161-7 (Hbk), ISBN 978-1-003-00161-4 (eBook).

  ***Abstract:*** Aging is considered as the single largest factor for age related disorders like Alzheimer's cardiovascular diseases, cataract and diabetes. Hence identification of pharmacological compounds that slow down normal aging processes and that enhance life span is the need of the hour. Medicinal plants and their isolates contain large amounts of polyphenols and have antioxidant capacity and can intervene in the aging process. One such herb is *Catharanthus roseus* (*C. roseus*). In this study *C. roseus* extracts showed *in vitro* antioxidant and free radical scavenging activity. This study has analyzed the longevity promoting effect of *Catharanthus roseus* on a popular model of aging research, *Caenorhabditis elegans* (*C. elegans*). Our results showed that the hydro alcoholic extract of *C. roseus* does extend the life span of wild type and a mutant strain of *C. elegans* and improves its stress resistance. Further investigations indicate that *C. roseus* could activate the FOXO head transcription factor Daf-16. It also enhances the expression of HSP 16.4 in wild type N2 bristol *C. elegans*.

*Following are a few list of publications during the year corresponding to our Administrative Director Dr. S.R. Dave, with his doctoral students at Gujarat University:*

- Darshna K. Patel, Devayani R. Tipre, Shailesh R. Dave
  **Decolourization, degradation and detoxification of dye house effluents by a developed bacterial consortium.**
  Journal of Experimental Biology and Agricultural Sciences, Volume 7(2), 211-221, April 2019, ISSN: 2320 – 8694.

- Bhumika R. Khatri, Devayani R. Tipre, Shailesh R. Dave
  **Comparison of Hydro- and Biohydrometallurgical Extraction of Metals from Waste Li-Ion Batteries of Cell Phone.**
  Journal of Sustainable Metallurgy (Springer), Volume 5 Number 2, 250-261, May 2019, ISSN: 2199-3823.

- Darshna K. Patel, Devayani R. Tipre, Shailesh R. Dave
  **Application of a downflow microaerophilic fixed film (DFMFF) reactor for the treatment of dye house effluents using a developed bacterial consortium.**
  Environmental Sustainability (Springer), 2, 145-155, May 2019.

- Asha B. Sodha, Devayani R. Tipre, Shailesh R. Dave
  **Optimization and kinetics of copper cementation from bio-leachate generated during the waste printed circuit board (E-waste) processing.**
  Environmental Sustainability (Springer), 2, 391-399, August 2020.

- Darshna K. Patel, Devayani R. Tipre, Shailesh R. Dave
  **Treatment of dye house effluents by a developed bacterial consortium: A Shake Flask Study.**
  International Research Journal of Biological Sciences, Volume 8-9, 17-25, September 2019, ISSN: 2278-3202.

- Shailesh R. Dave, Kinjal H. Upadhyay, Avni M. Vaishnav & Devayani R. Tipre
  **Exopolysaccharides from marine bacteria: production, recovery and applications.**
  Environmental Sustainability (Springer), 3, 139-154, April 2020, e-ISSN 2523-8922.

## 2.2. Papers Presented at Conferences

The following oral and poster presentations were made at the International Conference on "Bio-molecular and Biotechnological Aspects of Medicinal Plants" at Ahmedabad Management Association organized by L. M college of Pharmacy, Ahmedabad and sponsored by All India Council for Technical Education (AICTE) on 18th – 19th October 2019.

*Oral Presentation*

- Priya Vyas, Vincent J. Braganza
  **Multi-pronged Approach to Identify Compounds from Selected Medicinal Plants for Lung and Breast Cancer Chemotherapy.**

*Poster Presentations*

- Priyanka S. Dube, Vincent J. Braganza, Nayan K. Jain
  **Molecular docking studies of phytoconstituents identified in prominent medicinal plants for Type2 Diabetes Mellitus.**

- Riddhi Parmar, Vincent Braganza, H.N.Highland
  **HPTLC Profile and Free Radical Scavenging assay of extracts from leaves of *Bryophyllum pinnatum*.**

The following *oral presentation* was made at the National Seminar on "Present Day Biology: Impact of research at molecular and cellular level" organized by the Department of Biochemistry and Biotechnology, St. Xavier's College (Autonomous), Ahmedabad on 3rd - 4th January 2020.

- Disha Patel, Shailesh R. Dave, Vincent J. Braganza, Hasmukh A. Modi
  **Polyethylene biodegradation potential of thermophilic bacteria isolated from TuvaTimba and Dholera hot water springs of Gujarat, India.**

## 3. ACTIVITIES OF COMPUTER WING

Last year, an MoU was signed with Seven Seas Solution, Mumbai to work as a channel partner to jointly conduct educational courses and online exams at the Xavier Institute for Computer Sciences (XICS), the computer wing of the LCRD. Under this MoU, an Authorized Test Center Agreement was signed with Pearson VUE. From November 2019 to date, several exams have been conducted under this agreement. Besides, an agreement has also been signed with Paragon Testing Enterprises India Private Limited for English language proficiency online tests for those wishing to immigrate to Canada, become Canadian citizens, or study in Canada at all levels.

Besides maintaining and providing support for the computers at LCRD, our Hardware Technician Mr. Jalees Hadvaid, also assists with troubleshooting problems on the network for the Pearson and Paragon computer labs as and when needed, as well as in the installation and configuration of their computers.

Paper setting and mark sheet printing for the XBCE students continues at XICS, as the Controller of Examinations for the Xavier Board for Computer Education (XBCE), India.

During the lockdown period, Ms. Hita Rathore worked on the designing of logos for the ALBOAN Pilot Project,to be used for marketing the products of the women, and also for LCRD entrepreneurship programs. Following are a few samples of the logos developed:

## 4. DEVELOPMENTAL ACTIVITIES

- A software for **Data analysis and report of Teacher Feedback** of the Xaviers Loyola Primary School was developed at XICS by Ms. Hita Rathore. **Online questionnaire** was prepared for the overall evaluation based on their personal qualities, professional qualities, planning ability, effective teaching, and their classroom management. The teachers were invited to **fill the online forms** in the computer labs. of LCRD-XICS in

**April 2019**. Their inputs on school, student and their parents, along with their comments and suggestions were also accepted in the software. Various reports for each teacher along with the combined reports with graphs were prepared based on data analysis.

**Fr. Vincent briefing the teachers**

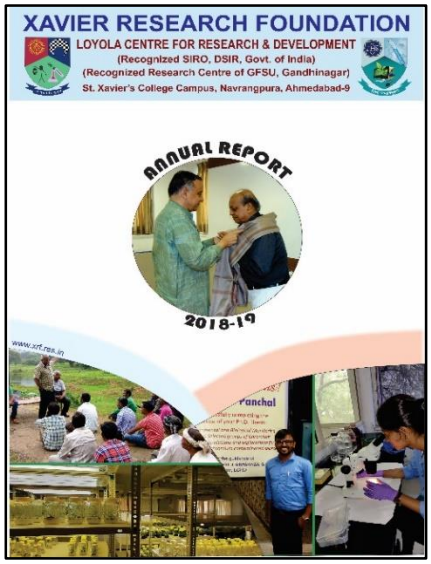
**Online Self-Evaluation for Teachers**

- A **five days workshop cum hands-on-practice for Class IX to XII students** from Ahmedabad, Gandhinagar, Nadiad and Kheda Dist. was organized at XRF-LCRD in collaboration with **Vikram A. Sarabhai Community Science Centre (VASCSC)**, Ahmedabad, from **21st – 25th May 2019**; on "Plant Tissue Culture" and "Plant Biotechnology with reference to DNA Fingerprinting". For the first session of "Plant Tissue Culture", the students learnt tissue culture techniques like culture media preparation, autoclaving, explant sample preparation, explant surface sterilization and inoculation. For the second session of "DNA fingerprinting", the students learnt plant DNA extraction & purification followed by Agarose gel casting, gel electrophoresis and gel documentation techniques. Students acquired important laboratory skills. The main challenges stemmed from the speed and accuracy of explant inoculation and pipetting, especially at the DNA extraction and gel loading stage. Feedback from students was largely positive, with the majority reporting that they had both enjoyed and learnt from the experience.

- On **31st May 2019**, **20 school students** came through **VASCSC** to our Centre to learn and make decorated plant tissue culture tubes with coloured medium and cactus plantation in pots (X-Plant Products).

**VASCSC sponsored training at LCRD**

- The **Annual Report** of our Xavier Research Foundation - Loyola Centre for Research and Development was published for the year **2018-19**, providing details about the Centre's various research and developmental activities during the past year. The printed report was distributed to our Trustees, benefactors, staff and students.




- **Mr. Srijan Timilsina**, a researcher in the field of Biological anthropology (a Fourth Year MBBS student) and **a past student of St. Xavier's Kathmandu (also a Guinness World Record Holder)**, visited LCRD from **18th – 22nd October 2019** to learn more about different aspects and methods of research in plant and cell culture, medicinal plants, bacterial inoculation and culture; the working of fluorescent microscope, PCR technology, DNA Fingerprinting etc.

**Srijan Timilsina during his visit to LCRD**

- The **Xavier Research Foundation (XRF) Board Meeting** for its trustees was held on **11th February 2020**. The minutes of the proceedings of the previous meeting were presented to the Board along with the follow-up action, and were duly passed. The Trustees were then updated about the developmental activities and achievements of the Centre since the last meeting; the audited financial report for 2018-19 and the proposed budget for 2020-21 were discussed and approved. The meeting was presided over by the Provincial of Gujarat Province, Fr. Durai Fernand, as the new incoming ex-officio President in the chair.

- Based on our earlier studies to extend the shelf life of chickoos, we had **applied for patent** for **"A method for delaying ripening of Sapota fruits (*Manilkara zapota*)",** which was published in the "Official Journal of Patents" in April 2016 and awaits further examination.

  Recently, the National Biodiversity Authority (NBA) cleared our above invention, and has stated specifically that it does not come under the purview of the Biological Diversity Act. **This certificate is a requirement for moving forward for the IPR**.

- As a part of XRF's healthy practices in research administration, we continue with our bi-monthly research meetings/presentations and Journal Club. For the Journal Club, the research staff is encouraged to select a recent scientific paper from a journal, preferably from the ones available in our library.

**Journal Club Presentations at XRF-LCRD**

- **XICE (Xavier Industrial Chemistry Enterprise), the entrepreneurial unit of XRF**, in collaboration with CYFC (Catholic Youth Formation Campaign), XSSS (St. Xavier's Social Service Society) and Edupreneur; has started an initiative for entrepreneurship for livelihood option.

  This year, three women from surrounding slums were trained as a part of the initiative, in making diyas at XICE. They were paid in return for offering their service, thus not only providing them with a skill but also helping them add to the income source of their family.

**Hands-on training to the women for the preparation of diyas**

**Optimized Diya product prepared using wax and paraffin with different fragrance**

**Diyas for Christmas**

- During the lockdown period, Mr. Ankur Baruah and Mr. Raymal Pagi (who were appointed to the posts of Marketing Executive and Social Entrepreneur in the ALBOAN Feasibility Study project), contacted our Director Dr. (Fr.) Vincent Braganza regarding FARMKIDZ, an initiative of their organization Institute of Social Pragmatics (INSPRA) to connect farmers (at present 1000 tribal farmers in Bhiloda block and nearly 500 farmers in the Bayad block of Aravalli district) directly to urban

consumers. We supported their initiative by giving space to them in our premises to store their vegetables, besides helping them with other logistics.

The initiative helps in getting easy access to fresh vegetables and fruits directly from the farm, besides less changes of hands and faster transport helps in maintaining their freshness and nutritional quality. At the same time, farmers get fair prices for their products and also incentivizes them to adopt sustainable agriculture practices viz. chemical free farming, growing local varieties etc.

This is a part of our vision mission to empower the rural population and those marginalized through handholding, to set up micro-entrepreneurial units for sustainable livelihoods.

**Space provided to the Bhiloda farmers at LCRD**

***INFRASTRUCTURAL DEVELOPMENTS:***

A few instruments have been added at the LCRD in the past year under a grant given by the Areez Khambatta Benevolent Trust:

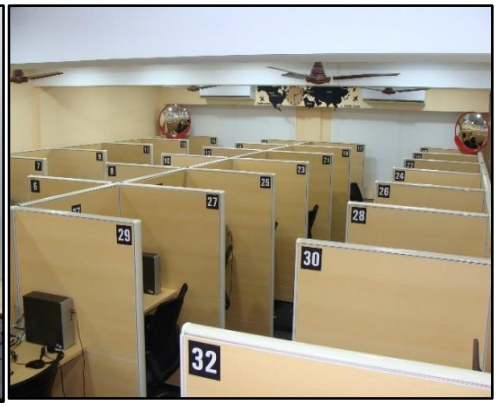
- Biosafety Cabinet – Class II Type A2 (IMSET)
- Fluorescence Microscope (Fusiontek)
- PCR Thermal Cycler Gradient (Labocon)

The XRF Greenhouse has been renovated with paver block fittings, moving towards soil-less farming using cocopeat grow bags. An automated drip irrigation system has been installed to save water. Designing for vertical farming to achieve higher productivity and year-round crop production, is underway. This renovation project has been possible with the help of **Mr. Parag Fatehpuria**, our chief resource person for the development and maintenance of our Green House.

**Renovated Greenhouse**

Under an MoU with XRF, two separate computer Labs have been set up by Seven Seas Solutions on the ground floor of LCRD, as authorized testing centres for Pearson and Paragon respectively.

**Pearson Testing Lab.**



**Paragon Testing Lab.**

# 5. ACHIEVEMENTS

- Dr. (Fr.) Vincent Braganza has been appointed by the Pune Provincial in the **Advisory Committee of the XINRM**, Ahmednagar for their **Masters Programme in Climate Change and Sustainable Development**.

- Ms. Priya Vyas **submitted her Ph.D. thesis** "Studies on the chemotherapeutic potential of some medicinal plants using cell lines, *C. elegans* and Swiss albino mice as testing models for lung/breast cancer" to the Gujarat University on **21st June 2019**, and **awaits defense**.

- On **3rd October 2019**, Dr. (Fr.) Vincent Braganza was **invited for a conference call** by Dr. John Boylan as a part of the **International Business Committee series** of the Dulles

Regional Chamber - **"Opportunities and Obstacles in doing Business Globally"**. Several others from India and the US were part of the webinar.


- **FOUR MSME projects** were submitted for the **National Bio Entrepreneurship Competition (NBEC) 2019** organized by C-CAMP to attract, identify, and nurture bio-entrepreneurs across India with path breaking business ideas for societal impact.

  **NBEC shortlisted Dr. Sudha Sahay's start-up project** "Production of Mycophenolic Acid (MPA) from *Penicillium brevicompactum* using Solid State Fermentation (SSF)" **for Regional Presentation Round** held in Mumbai on the **1st of November 2019**.

  As a start-up project that pitched in Round 2, the project has been **awarded <u>$1000 AWS Activate credits</u>** by C-CAMP in partnership with Amazon Web Services (AWS).

- **Dr. Disha Patel successfully defended her Ph.D. thesis** "Isolation, Characterization, Applications and Molecular Identification of Thermophilic Microflora from Few Hot Springs of Gujarat" in an open viva-voce exam on **13th February 2020** at the Department of Life Sciences at the Gujarat University (**Guide: Dr. H.A. Modi, Co-Guide: Dr. (Dr.) Vincent Braganza**).

**(1) Thesis Defense at Gujarat University**


**(2) At XRF-LCRD**

- As a requirement prior to applying for Intellectual Property Rights (IPRs), the following biological resources have been registered for research **at the Xavier Research Foundation** by the **National Biodiversity Authority (NBA)**, Ministry of Environment, Forest and Climate Change, Govt. of India.

  - "Isolation and identification of bioactive molecule from ***Nyctanthes arbortristis*** against cancer" … (the night-flowering jasmine or Parijat)
  - "Mass Production of ***Curculigo orchioides*** and Phytochemical Analysis" … (Kali Musli)

- ***Dr. (Fr.) Vincent Braganza:***

  - **Chaired the session** on oral presentations at the **International conference on "Bio-molecular and Biotechnological Aspects of Medicinal Plants"** at Ahmedabad Management Association, organized by L. M college of Pharmacy, Ahmedabad and sponsored by All India Council for Technical Education (AICTE) on **18th – 19th October 2019**.
  - Was invited by St. Xavier's College Kathmandu to give the **keynote address** for the International Microbiology conference **"Unraveling Life Sciences - A quest for sustainability"** on **29th November 2019**.
  - Was invited **as a speaker** at the **"National Seminar on Present Day Biology**" organized by the Department of Biochemistry and Biotechnology, St. Xavier's College Ahmedabad on **3rd - 4th January 2020**.

- ***Dr. S.R. Dave:***

  - Was appointed member of **Joint Selection Committee** of group P-I, II and III post of **GSBTM, GBRC**.
  - Was appointed member of **Kick off meeting** for research projects support under **Networking program on environmental biology, GSBTM**.
  - Was appointed **RPC member** at Institute of Research and Development, Gujarat Forensic Sciences University **(GFSU**) and at Institute of Science, **Nirma University**.
  - Was appointed as **Chairperson** for **Internal Scrutiny Committee GSBTM**.
  - Was invited on the **Selection Committee for Best teacher award** (under-graduate and post-graduate) by **Gujarat Science Academy for 2019-20**.
  - Was appointed as a **Member Board of Studies** for the Faculty of Science for Microbiology / Biotechnology, at **LDRP Institute, Kadi University**.
  - Was invited for lectures at the **National Symposium on Research Proposal Drafting and Funding** at **RK University Rajkot** on **14th September 2019**; and at the GSBTM sponsored **BT-CBC Crash Workshop-2019** organized by Pramukh Swami Science and H.D.Patel Arts College Kadi
  - **Chaired** a session at the **"National Seminar on Present Day Biology"** organized by the Department of Biochemistry and Biotechnology, St. Xavier's College Ahmedabad on **3rd - 4th January 2020**.

- Was invited as **Ph.D. thesis examiner** at Rani Durgavati Vishwavidyalay Jabalpur, ICAR-IARI New Delhi, Shivaji University Kolhapur and Rashtrasant Tukadoji Maharaj (RTM) Nagpur University.
- Was invited to deliver **experts lectures** at **Nirma University** and **Mahatma Gandhi Labour Institute**.
- Was invited as a **member** of the Board of Post Graduation Studies, Babasaheb Bhimrao Ambedkar **(BBA) University, Lucknow**, on 27th February 2020.

- ***Dr. Sudha Sahay:***

  - Was invited as a **Judge** for the **Poster Sessions** conducted during the "National Seminar on Present Day Biology: Impact of research at Molecular and Cellular Level" organized by the Department of Biochemistry and Biotechnology, St. Xavier's College Ahmedabad on **3rd - 4th January 2020**.

## 6. MISCELLANEOUS

- A **Media Workshop** organized by **Gurjarvani** for giving media training to Jesuit Scholastics, was held at LCRD from **1st – 10th May 2019** (in its Audio Visual Room and Computer Lab).

**Gurjarvani Media Workshop at LCRD**

- **Dr. Johnson Stanslas**, **Head of the Pharmacotherapeutics Unit** at the Dept. of Medicine, University Putra Malaysia, and founder and current President of Malaysian Association of Cancer Research (MACR), visited our Centre in **October 2019**. He appreciated and lauded our work on breast and lung cancer.

- A small **tea get-together** was organized on **19th November 2019**, to **express our gratitude to Fr. Francis Parmar** and **Dr. (Fr.) Lancelot D'Cruz** for their support and encouragement during the years that they were the President and Vice-President of our XRF Trust, in their capacities as Provincial of Gujarat Province and Rector of Xavier Residence, respectively.

**Get-together to express our gratitude to Fr. Francis Parmar and Fr. Lancelot D'Cruz**

- Each year the Xavier Research Foundation (XRF) celebrates its Foundation Day (2nd of February) with its staff and well-wishers. This year we organized a high tea on the **20th of February 2020**.

  On this occasion our *C. Elegans* laboratory for Cancer, Ageing and Memory was named in honour of the **Areez Khambatta Benevolent Trust**, in recognition of their support for our education and research work. **Mr. Piruz Khambatta** (Chairman, Rasna Pvt. Ltd. and Founder Trustee-Areez Khambatta Benevolent Trust), did the unveiling at this naming ceremony.

  We also felicitated our librarian, **Ms. Dipal Joshi**, on completing **25 years of service at the Centre**. The Rector, Fr. Vinayak Jadav, conferred her with a silver medal and shawl in recognition of her services.


**Inauguration of *C. Elegans* Lab. by Mr. Piruz Khambatta. *and***
**Felicitation of Ms. Dipal Joshi by Dr. (Fr.) Vinayak Jadav**

- Cactus House Blooms

**Cactus Blooms in XRF-LCRD Cactus House**

# 7. FINANCIAL INVESTMENTS

| Investments | Amount | Period | Interest Rate |
|---|---|---|---|
| HDFC (Corpus) | 20300000.00 | For 3 years (in 2019) | 8.08% |
| HDFC | 500000.00 | For 1 year (in 2020) | 6.68% |
| HDFC | 500000.00 | For 1 year (in 2020) | 6.68% |
| HDFC | 300000.00 | For 1 year (in 2020 ) | 6.68% |
| **TOTAL** | **21600000.00** | | |

# 8. INITIATIVES/PROJECTS IN THE PIPELINE

- Patenting of Design of Make and Break Production (MBP) Unit
- Scale-up of isolation and production of phyto-chemo therapeutic agents for breast cancer and lung cancer
- Bacterial decontamination (sulphur, cyclic-ring compounds, hetero-cyclic ring compounds) of Industrial wastes
- Developing soil fertility enhancing microbiological products
- Upright food and flower gardening for organic farming
- Enzymes from Thermophilic bacteria of Gujarat
- DNA bar-coding – Mangrove vegetation
- Nutraceutical formulation from *Curcurligo Orchioides*
- Atomic Absorption Spectrophotometer based analysis for IFFCO
- Certificate/Diploma in Research Instrumentation and Methods
- Stevia production for sugar substitution through PTC
- Soap making and other value added products from oil of Mahua
- Plastic degradation through thermophilic organisms

## 9. OUR COLLABORATORS

- Rasna Pvt. Ltd., Ahmedabad
- Jay Chemicals Industries Limited, Ahmedabad
- Gujarat Forensic Sciences University (GFSU), Gandhinagar
- Gurjarvani, Ahmedabad
- H.K. Acharya and Company, Ahmedabad
- MarkPatent.Org
- Seven Seas Solution, Mumbai
- Pearson VUE, Noida
- Paragon Testing Enterprises India Private Limited, Mumbai
- Edupreneur, Ahmedabad
- Catholic Youth Formation Campaign, Ahmedabad
- St. Xavier's Social Service Society, Ahmedabad
- Vikram A Sarabhai Community Science Centre, Ahmedabad
- Parag Fatehpuria Consulting, Ahmedabad
- FARMKIDZ, Ahmedabad
- Jivan Vikas Kendra, Narukot
- The Sabarkantha Jesuit Education Society, Poshina
- Ekalavya Education Foundation, Ahmedabad

## 10. LIST OF BENEFACTORS

Contributions by the following in cash or kind during the year are sincerely appreciated and acknowledged:

- Anthony D'Sa
- Apostolic Carmel Society
- CNN Marketing
- D M Innovators
- Eklavya Education Foundation
- Indraben Doshi
- Jesuit Community Xavier Residence Ahmedabad
- John D'Costa
- Judith Froehlich-Klamut
- Nancy Dorfmeister
- Parag Fatehpuria
- Pinky Barth
- Punam Zutshi
- Simon & Rebecca Braganza
- Xavier Kelavani Mandal

# STAFF MEMBERS

*Management:*

| | |
|---|---|
| Dr. (Fr.) Vincent Braganza | Director (Research) |
| Dr. S. R. Dave | Administrative Director (Research) |
| Dr. Sandip Kumar Ghosh | Emeritus Scientist (Research) |
| Ms. Shweta Wadhwa | Manager (Administration & Research) |

| | |
|---|---|
| Dr. Sudha Sahay | Senior Scientist |
| Dr. Mayur Panchal | Junior Scientist |
| Dr. Disha Patel | Post Doctoral Fellow |
| Ms. Hita Rathore | Scientific Officer (Research and Computers) |
| Ms. Priya Vyas | Research Scholar |
| Ms. Riddhi Parmar | Research Scholar |
| Ms. Priyanka Dube | Research Scholar |
| Mr. John D'Costa | Research Scholar |
| Ms. Saeida Saadat | Research Scholar |
| Mr. Anil Parmar | Accounts & Maintenance Officer |
| Ms. Dipal Joshi | Librarian |
| Mr. Jalees Hadvaid | Maintenance Technician (Hardware & Instruments) |
| Mr. Hitesh Macwan | DTP Operator, Librarian & Stores (Chem. & Glassware) |
| Mr. Babubhai Bamania | Gardener (Botanical gardens) |
| Mr. Justin Christi | Office Assistant cum Driver |
| Mr. Ramprakash Kori | Office Assistant |
| Mr. Jayesh Rathore | Office Assistant cum Gardener |

# RESEARCH ADVISORY BOARD

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Outstanding Scientist & J.C. Bose National Fellow, Physical Research Laboratory, Ahmedabad

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Mr. Piruz Khambatta
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Dr. Sandip K. Ghosh
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Ms. Shriya Damani
Co-Founder & CEO, Skyquest Technology Consulting Pvt. Ltd., Ahmedabad

Prof. Susan Eapen
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Mr. Tushar Jani
Private Consultant (Formerly of FICCI), Ahmedabad

Dr. Vincent J. Braganza
Director, Loyola Centre for Research & Development, Ahmedabad

Dr. Vivien Amonkar
Rtd. Head of Depts. of Microbiology and PG Biotechnology, St. Xavier's College, Mumbai

**FOR INR donations:**

If making a donation through cheque, the cheque should be written in favour of **"XAVIER RESEARCH FOUNDATION (RESEARCH GRANT)"**, and made payable at Ahmedabad.

For **online contributions in INR**, our account details are as follows: (all donations in Indian Rupees to the Xavier Research Foundation Trust are exempted from tax under Section 80-G of Income Tax Act)

**Account No:** 03420100007835
**Account Name:** Xavier Research Foundation (Research Grant)
**Bank:** Bank of Baroda
**Branch Code:** UNIAHM
**Branch:** University Campus Branch, Navrangpura, Ahmedabad - 380009
**IFSC Code:** BARB0UNIAHM
**MICR Code:** 380012043

**FOR FOREIGN donations:**

For **online contributions in foreign currency**, our account details are as follows:

**Account No:** 002401037736
**Account Name:** Xavier Research Foundation - FCRA
**Bank:** ICICI Bank
**Branch:** JMC BRANCH, Opp. Parimal Garden, Ellisbridge, Ahmedabad - 380006 (Gujarat. INDIA)
**IFSC Code:** ICIC0000024
**Swift Code:** ICICI-NBB024
**MICR Code:** 380229002

**Please NOTE:**
If you have initiated an online transfer or for any clarifications, please write to us at **lcrd@xrf.res.in**.

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