



FRLHT-TDU

ANNUAL REPORT 2021-22



THE UNIVERSITY OF TRANS-DISCIPLINARY
HEALTH SCIENCES & TECHNOLOGY

Acknowledgement

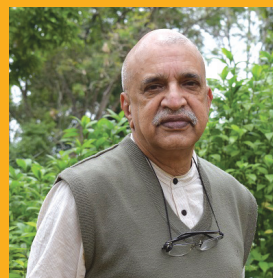
- Ministry of Environment , Forest & Climate Change, Govt. of India
- Department of Biotechnology, Govt. of India
- UNDP India, New Delhi
- National Medicinal Plants Board, New Delhi

- State Forest Departments of Chhattisgarh, karnataka, kerala, Sikkim & West Bengal
- Department of AYUSH, Govt. of Karnataka
- State Biodiversity Boards of Manipur, karnataka, Telangana & Haryana States
- State Medicinal Plants Board, Chhattisgarh

- Tata Education Trust
- Dabur India Limited
- JSW Steel Limited
- RIST - Rural India Supporting Trust

- Ashoka Trust for Research in Ecology and the Environment
- Attakkalari Centre for Movement Arts
- BUGWORKS
- Dakshin Foundation
- Gaiagen Technologies
- The Institute of Bioinformatics and Applied Biotechnology
- Institute for Stem Cell Biology and Regenerative Medicine
- The Institute of Public Health
- National Centre for Biological Sciences
- National Institute for Advanced Studies
- Poorna Learning Centre
- St.John's Research Institute
- Srishti Institute of Art, Design and Technology
- Suchitra Cinema and Cultural Academy
- Takshashila Institution

Chancellor and Vice Chancellor Message



TDU is growing steadily in an organic fashion. We continue to focus on innovation. All our research, outreach and training programs are innovative in nature. Innovative education in the Indian University context implies low revenues.

It is evident from the fact that 43 projects were implemented by seven centers that the year 2021-22 has been a productive year. Ninety-three percent of the projects were research programs, and the rest were outreach and education programs. The thrust areas in research are metabolism, neurobiology, nutrition, food technology, mal-nutrition, multi-omics, microbiome, genetics and conservation. TDU thus predominantly remains as per its legislative mandate a research university.

In 2021-22 two innovative masters programs were initiated viz., MSc Life Sciences (Ayurveda-Biology) and MSc Conservation Practice. The Ayurveda-Biology program is the first of its kind in India and globally. It represents a cross-cultural endeavour combining systemic and molecular approaches to understanding biological change. The conservation practice program designed jointly by ATREE (senior partner) and TDU, represents an innovative multi-disciplinary sustainable science approach for design of conservation action.

The table below gives a glimpse of the students profile on TDU rolls in the year 2021-22:

Sl. No.	Program	Students enrolment (2021-22)
	Ph.D	22
	M.Sc	38
	B.Voc	265
	Diploma (Varmam/Acupressure Therapy)	19
	Certificate (Panchakarma and Yoga)	58
	Grand Total	402

At the bachelors level the B.Voc program is another extremely innovative TDU initiative that gives hand on training to students in industry based work places in a number of vocational areas like Medical Laboratory Technology (MLT) and Medical Imaging Technology (MIT).

We are pleased with the progress in 2021-22 and congratulate the highly motivated faculty and research students of the University.



Sam Pitroda
Chancellor



Darshan Shankar
Vice Chancellor



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1. Centre for Ayurveda Biology and Holistic Nutrition

Sl. No.	Title of research/outreach/ education projects implemented in 2021-22	Source of funding	Team members associated with each project
1	RIST Holistic Nutrition – Integrative Nutrition Database	Rural India Support Trust	Gurmeet Singh, Subrahmanya Kumar, Varun Subramania, Lavanya devi, Nadana Vinayagan, Arun Bhanu (with Centre for Data Sciences)
2	RIST Holistic Nutrition – Healers Program on Iron Deficiency Anaemia	Rural India Support Trust	Gurmeet Singh, Subrahmanya Kumar, BN Prakash, Shridevi Gothe, Manoj Mathapati (with Centre for Local Health Traditions)
3	RIST Holistic Nutrition – Ayurveda Dietetics Program	Rural India Support Trust	Megha, Madhumita
4	RIST Holistic Nutrition – Functional Foods Research & Design Program	Rural India Support Trust	Gurmeet Singh, Shridevi Gothe, Abdul Mateen, Shilpa Naveen, Manoj Mathapati, Subrahmanya Kumar, Vishnu Prasad, Ashwini Godbole
5	RIST Holistic Nutrition – Plant Proteins	Rural India Support Trust	Gurmeet Singh, Abdul Mateen, Manoj Mathapati
6	RIST Personalized Nutrition & Gut Health Program	Rural India Support Trust	Gurmeet Singh, Pavithra N, Shridevi Gothe, Poornima, Lavanya Devi
7	Bosch-iAIM-TDU Program on Tier 4 of Public Health	Bosch & RIST	Gurmeet singh, Prakash BN, Subrahmanya Kumar, Varuna Subramania, Poornima, Prasan Shankar, Megha (with Centre for Data Sciences, centre for Local Health Traditions, centre for Clinical Studies, iAIM Hospital)
8	RIST Degree, Internship & Certificate programs	Rural India Support Trust	Gurmeet Singh, Shridevi Gothe, Venkatraj, Shobha Udipi, Vishnu Prasad, Subrahmanya Kumar, Ashwini Godbole, Mohan Kumar, Megha
9.	Identification of actives (e.g. Vit C) in Amla	RIST	Shridevi, Manoj
10	Scientific Evaluation of Marketed Substitutes for Medicinal Plants Facing Conservation Threat	Dabur India Ltd.	Vishnuprasad, Ashwini Godbole, Ms. Ashwini Elango, Ms. Seema Gaddigeri, Mr. Prasanna Simha, Subrahmanya Kumar

Sl. No.	Title of research/outreach/ education projects implemented in 2021-22	Source of funding	Team members associated with each project
11	Human Microbiome Initiative of Select Endogamous populations in India	Department of Biotechnology (DBT)	Sanket Sharma, Abhilash, Venkatesh, Subrahmanya Kumar, Sayali, Sumit, Urmila, Prajakta, Prasanna, Chaya Bharati Chandra,
12	Multi-omic approaches and mass spectrometry based tissue metabolite imaging towards understanding metabolites localisation and metabolic pathways in specific cell/tissues of key medicinal plant, <i>Dysoxylum binectariferum</i> .	SERB, Government of India	Mohana Kumara P. (PI) Ms. Madhshree A H
13	“Development of sustainable technology for the production of anticancer chromone alkaloids, rohitukine and dysoline from Indian forest trees” –[BT/PR31331/TRM/120/227/2019]”	DBT, Government of India	Mohana Kumara P. (PI) Jagadish (CO-PI) Varun E, Soumya Bhat
14	“Development of SSR markers and assessment of genetic diversity of natural populations of <i>Pterocarpus santalinus</i> L.f. distributed in the Eastern Ghats, India”	NBA, Government of India	Mohana Kumara P. (Co-PI), Prabuddha H R (PI) Madhshree A H Sneha M V
15	Stabilization of fats (ghee and oil) by natural antioxidants	RIST	Gurmeet Singh, Shridevi Gothe
16	Ayurveda Biology understanding of metabolic diseases	Institutional	Anjana, Sania Kouser, Subrahmanya Kumar, C. N. Vishnuprasad
17	To test the benefits of Jackfruit365 Green Jackfruit flour in a model animal, <i>Drosophila melanogaster</i> (completed July 2021)	God’s Own Food Solutions Private Limited	Vaibhav Wagh
18	Does exposure to early life malnutrition alter the adaptation of digestive enzymes to later-life dietary excesses? An animal model investigation. (Ongoing)	DST-SERB Start-up Research Grant	Vaibhav Wagh, Debashis Rout
19	Understanding biological effect of Ayurvedic Nootropics		Ashwini Godbole, Anjaneyulu J, Varghese Thomas, Vaibhav Wagh, Debashis Rout, Ashwini Thakare, Prasanna K Simha, Pushpendra Jat, Swathi G H, Arman Deep Singh, Bhaktee Dongaonkar (NCBS-TIFR)

1. Project Title: RIST Holistic Nutrition – Integrative Nutrition Database

Funder – Rural India Support Trust

Relevance: Foodomics & food typing are emerging areas of research enabling creation of foods of the future that address human healthy, societal health & planetary health. They bring together cutting edge areas of molecular gastronomy, culinary sciences, microbiome, personalised nutrition with novel processing & food structuring techniques and traditional knowledge of food. This program aims to develop a database that captures integrative properties of food and allows for applications to run of it and thereby becomes the engine that powers this field.

Highlights: An integrative Nutrition Database, AyurAhaar, has been compiled and uploaded on the cloud (www.ayurahaar.org) as an open access knowledge repository. The database comprises of 2500 recipes curated from 34 classical texts spanning 3000 years, from Charaka Samhita to Bhojana Kutuham. The recipes have been mined for food ingredients. Food ingredients from NIN Indian Food Composition Tables & FSSAI's Schedule 4 list of food supplements have also been added to the list of food ingredients in the database. 1500+ food ingredients are now part of the database. Nutritional composition of the food ingredients, their Ayurveda pharmacological properties, their molecules are also included in the database. This is a one of a kind food & nutrition database that can be used for research & concept generation for new product development.

Database address: www.ayurahaar.org

Team Members: Gurmeet Singh, Subrahmanya Kumar, Varun Subramania, Lavanya devi, Nadana Vinayagan, Arun Bhanu.



2. Project Title: RIST Holistic Nutrition – Healers Program on Iron Deficiency Anemia

Relevance: Iron deficiency anemia is a huge public health challenge for India. The National Family Health Survey 5 data shows that nearly 30% of Indians are anemic and the number is close to 50% for pregnant women & infants. This project aims to use a education + product combination approach executed through healers and social entrepreneurship models to tackle anemia.

Highlights: The first pilot has been executed in Nilgiri District in collaboration with Nilgiri Adivasi Welfare Association. As part of this pilot 70 healers were taken through workshops on iron deficiency anemia – its symptoms, its long term health issues, and lifestyle & diet habits to tackle it. 10 super healers were identified from this pool who were then further trained for in-home visits & community training. Each healer then visited 50 families and disseminated the knowledge to communities. 100 individuals were selected from this pool for a community trial where the knowledge dissemination was combined with a daily consumption iron-rich snack designed by the RIST Functional Foods research team. The results indicate an improvement of the Hb levels of the participants. In the next phase we will extend this community trial and cover 50 villages in the Nilgiri's.



Community Training



Healers Training Program



Demo Preparation

Team Members: Gurmeet Singh, Subrahmanya Kumar, BN Prakash, Shridevi Gothe, Manoj Mathapati



3. Project Title: RIST Holistic Nutrition – Ayurveda Dietetics Program

Relevance: In Ayurveda, health of an individual is supported by three aspects: aahar (food), vihara (lifestyle) and brahmancharya (restraint). Ayurveda is unique in having a major emphasis on foods and diets, as well as guidelines to personalise them for wellbeing. How are daily food items understood in Ayurveda and how can they be used in contemporary diets for wellbeing? This program has been designed to provide knowledge seekers an answer to this question. Originally for dietitians and nutritionists, the program is now open to all and has had a wide spectrum of professionals as participants.

Highlights:

- Unique content. This is the only program in Ayurveda dietetics that offers a modern perspective on nutrition along with the Ayurveda content. The relevance to contemporary biochemistry and dietetics helps with assimilation of content. Powered by games and assignments designed for participants to understand and start using Ayurveda dietetic principles.
- “Introduction to Ayurveda Dietetics” revised and launched as a 15hr, 1 credit course from November 2021. In line with NEP2020, this would allow students to take this course for credit.
- Advanced Ayurveda Dietetics completed as a 30hr, 2 credit course.
- ~ 250 participants trained in 21-22.

List of publications:

- Ayurahaar: Fruits & Vegetable in Ayurveda.
Rasapanchaka of commonly consumed fruits and vegetables.
Designed by Samyukta Rao. Written by Madhumitha Krishnan. Edited by Megha.
- “Introduction to Ayurveda Dietetics”
Textbook to compliment lectures released as a ready reckoner for our programs.
Written by Madhumitha Krishnan and Megha. Designed and edited by Megha.

Team Members: Megha, Madhumita, Subrahmanya Kumar, Girish Kumar



Ayurveda Dietetics Program

Centre For Ayurveda Biology & Holistic Nutrition

- Education program on food concepts in Ayurveda.
- Modern science perspective on traditional dietary principles.
- Authentic information from classical texts.
- Learn through games and assignments.

Online courses

Introduction to Ayurveda Dietetics

15hr, 1-credit ; M-F, 1.5 hrs/ day

Feb, Apr, Jun, Aug, Oct 2022

bit.ly/introad22

Eligibility

High school biology

Keen interest in food & nutrition

Ayurveda Biology of Nutrition

45 hr, 3-credit

Bespoke course offered to colleges

For BSc/ MSc students of Nutrition,
Dietetics

Advanced Ayurveda Dietetics

30hr, 2-credit ; Nov 2022


bit.ly/AADDec21

Eligibility

Completed Introduction to Ayurveda Dietetics



The University of Trans-Disciplinary Health Sciences and Technology

 +91 80 2856 8000 (Monday to Friday 9.00 am - 5.00 pm)

Ayurveda Dietetics Program

4. Project Title: RIST Holistic Nutrition – Functional Foods Research & Design Program

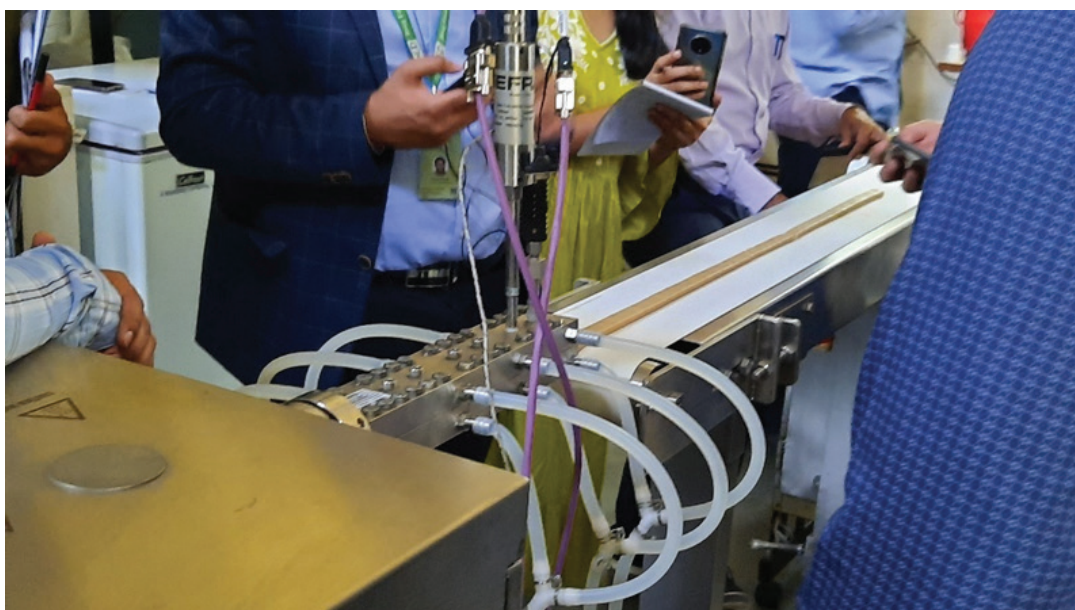
Relevance: Food first solutions are being increasingly explored for human health. Functional foods can play a key role here. The program focuses on developing functional foods for iron deficiency anemia, balanced plant-based proteins, glycemic control, brain health, respiratory health and gut health.

Highlights:

- Pilot plants, supported by a rapid prototyping research kitchen, analytical labs, and bioassays have been set-up to support the program. A number of products are at various stage of development for eventual transfer to industry & social entrepreneurship models. Some of these are described below.
- Super Green + Amla for Iron Deficiency Anemia – tested with 100 individuals in a community study in Nilgiri District
- Botanical Tea Mix for Respiratory health – tested in Bosch CSR study on 250 subjects in 5 villages around Bidadi.
- Stabilized Botanical Ghritas using natural antioxidants & Brahmi for brain health – tested using bioassays
- Amla & Turmeric combinations for gut health & glycemic control – tested using bioassays
- Plant-based proteins for meat analogues – technology transfer to industry professionals through workshops & projects. 9 Workshops conducted. Professionals from 30+ industries imparted training.
- Fermented Foods – A Kombucha drink with ayurveda botanicals infused and a fermented gruel extract are under development.
- Araka Tech – Botanical & algal distillates are being developed for industry partners through projects



Training Workshop on Meat Analogues by Twin Screw Extrusion Technology and Productization



Training Workshop on Meat Analogues by Twin Screw Extrusion Technology and Productization

Team Members: Gurmeet Singh, Shridevi Gothe, Abdul Mateen, Shilpa Naveen, Manoj Mathapati, Subrahmanya Kumar, Vishnu Prasad, Ashwini Godbole



5. Project Title: RIST Holistic Nutrition Program on Plant Proteins

Relevance: Plant Proteins are more sustainable than animal proteins as they much lower greenhouse gas emissions and lower energy, water & land footprints. However they have challenges of allergenicities & imbalanced nutritional profiles. There are also challenges of taste, texture & stable formats that fit into consumers daily lives.

Highlights: As part of the program pilot plants for texturizing plant proteins, homogenising plant protein milks and plant proteins bakes have been setup. These are supported by physicochemical analysis and texture, colour, and haptic analysis.

We are working on plant-protein based foods that could deliver 12g quality proteins in a mid-day meal program at the target cost of Rs3.

In addition industry sponsored projects have been executed to design plant-based proteins for industry partners. 9 workshops (online and face-to-face) have been executed to train industry professionals on plant proteins.



Workshop on pilot plants for texturizing plant proteins

Team Members: Gurmeet Singh, Abdul Mateen, Manoj Mathapati



6 Project Title: RIST Personalized Nutrition & Gut Health Program

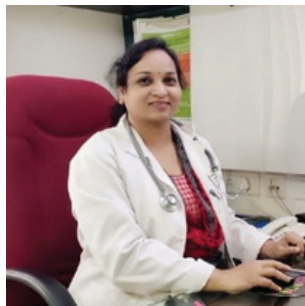
Funder: Rural India Support Trust

Relevance: The goal of the program is to improve overall wellness of individuals through personalised nutrition for the masses. The program is working on integrating Prakriti-Dosha framework with measures such as microbiome, post-prandial responses to standardised tests foods, and wearables to arrive at personalised nutrition algorithms.

Highlights: Tools such as Prakriti QDA, Quality of Life, Swasthya QDA, Diet Q, clinical measures such as 6-m-test, post prandial glyceimic, inflammation & lipemic profiles, microbiome analysis have been field tested & pipelines developed.

We have collected diet, prakriti and medical history data for 500+ individuals which is now being analysed for insights & developing bodytype-foodtype mapping algorithms. A workshop on Microbiome & Nutrition is being executed in July 2022 and another on Personalised Nutrition in September 2022 to disseminate our results.

Team Members: Gurmeet Singh, Pavithra N, Shridevi Gothe, Poornima Devkumar, Lavanya Devi.



7. Project Title: Bosch-iAIM-TDU Program on Tier 4 of Public Health

Relevance: The program is working on the public health goal of ‘health for all’ through community empowerment. This feeds into the design of an innovative strategy recognized today in the National Health Policy 2017, which advocates building a “non-institutional” tier 4, focusing on “preventive, promotive health” and “wellness”, to complement the existing 3 institutional tiers of the healthcare system. An integrative approach that combines diet & lifestyle and involves daily use products, yoga and dietary recommendation is being developed and field tested for access, affordability, adoption and impact.

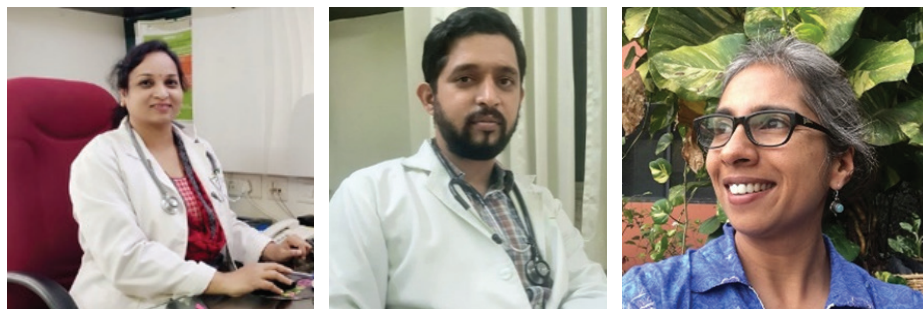
Highlights: A pilot was executed with Bosch-CSR & IAİM. The pilot study represented a key building (learning) block for a major future intervention to enhance self-reliance of millions of homes in building immunity and resilience (a lesson from COVID) through lifestyle change, food, and simple herbs. The study involved 250+ subjects in 5 villages around Bidadi.

The pilot study has shown:

- The interventions employed are effective in improving general wellness as measured by the Holistic Health Score, WHO Quality of Life score, self-reported incidences of flu & cold, Clinical measures (BOLT, 6-minute walk test), blood chemistry markers.
- The intervention is ‘sticky’ as the study completion was greater than 95%.

Our future goal of ‘tech + touch’ is targeting a final per capita cost that fits a program for the masses. Subsequent pilots with sharply defined objectives will be needed to fill in gaps needed for full scale rollout.

Team Members: Gurmeet Singh, B N Prakash, Subrahmanya Kumar, Varuna Subramanian, Poornima, Prasan Shankar, Megha



8. Project Title: RIST Degree, Internship & Certificate programs in Holistic Nutrition & Food Futures

Relevance: The goal of the program is to develop human resource capacity in trans-disciplinary approaches to food first solution for holistic health – health of the individual, society & planet. This human resource will not only take the knowledge & technologies developed at TDU but also other such similar institutions forward into peoples lives through research & translation activities.

Highlights: Three programs have been created.

Internship Program on Food Futures - The RIST Future Foods Internship Program is created for students enrolled in Bachelors & Masters programs in various colleges seeking external internships as part of their curriculum requirements and having a strong interest in Food First solutions to health & wellness.

The internships are flexible can be from 1 months to 12 months. Students are given a research topic in one of the five verticals in the future foods program - Functional food design, Sustainable proteins, Food Processing & Livelihoods, Personalised Nutrition, Healthy Gardens, Healthy Kitchens, Healthy Lives.

PhD Program – 8 PhD students have been enrolled in the program.

- MSc by Research in Food Science, Technology & Innovation – This has been pilot tested with 2 enrollments. 6 Elective courses have been developed. The program targets those students seeking an education that goes beyond the classroom with focus on hands-on research & functional food development, those wanting to create foods of the future by bringing together cutting-edge areas of molecular gastronomy, culinary sciences, microbiome, personalised nutrition with novel processing & food structuring techniques and traditional knowledge of food. Examples of topics now available include Protein processing including texturizing vegetarian proteins for meat analogue applications& plant-based milks, Extruded snacks using millets & native varieties of rice, Designing functional foods for iron deficiency anemia, glycemic control & brain health, Natural anti-oxidants for oils & ghees, Botanical ghrita's & oils, Aroma extraction from botanicals & araka's, Fermented foods & beverages including Kombucha, Micro-processing unit design for tea & botanicals such as amla & greens for value addition, Integrative personalized nutrition for the Masses



Scientific Kitchen - Tasting sessions and Training Program



Scientific Kitchen - Tasting sessions and Training Program

Team Members: Gurmeet Singh, Shridevi Gothe, Venkatraj, Shobha Udipi, Vishnuprasad, Subrahmanya Kumar, Ashwini Godbole, Mohana Kumara P, Megha



9. Project Title: Workshop on “Authentication of Medicinal Plants & Phytochemical Profiling of their Actives”

“Authentication of Medicinal Plants & Phytochemical Profiling of their Actives”

- No of students: 34
- Goals of program: to introduce students to use of HPTLC as a technique for
- Separation & identification of actives in medicinal plants
- Feedback of students: very good, they want part 2 of the course
- Photographs of teaching learning process

Table on faculty involved

S.No.	Name of faculty	Topic taught
1	Dr. Gurmeet Singh	Intro: Authentication of Medicinal Plants
2	Dr. Abdul Kareem	Taxonomic authentication (WHO aspects)
3	Dr. Shovan Ganguli	Metabolomics
4	Dr. Noorunissa Begum	Taxonomic authentication
5	Dr. Pavithra Narendran	DNA Barcoding
6	Dr. Venkatraj Narayanan	HPTLC – use in Med Plant Authentication



10. Project Title: Scientific Evaluation of Marketed Substitutes (alternatives) for Medicinal Plants Facing Conservation Threat

Relevance: The populations of several medicinal plant species including Ashoka [asoca (Roxb.) Willd], Vidanga (*Embelia ribes* Burm.f.) and Sariva [*Hemidesmus indicus* (L.) R.Br.] are some them. All of them are highly demanded because of their unique therapeutic potentials. This study focused to develop bioequivalent substitutes for these three species using pharmacology tools. Authentic substitutes can make the supply chain for medicinal plants be robust, along with lessening the burden on endangered species of medicinal plants.

Highlights: During the study, different samples of 'Arishtas' were prepared with original drugs and their substitutes and in vitro, in vivo small animal and pre-clinical experiments were taken up to examine the pharmacological similarities between the products prepared using original and substitute species.

'Ashokarishta' were prepared using the barks of *Saraca asoca* (authentic Ashoka), and its substitutes, *Shorea robusta* and *Polyalthia longifolia* and the twigs of *Saraca asoca*. The Arishtas were compared for estrogenic activity. The original sample and substitutes showed significant estrogenic potential indicating the possibility of valid substitutes for *Saraca asoca*.

Embelia tsjeriam-cottam could be an authentic substitute for *Embelia ribes* (Vidanga) because the Vidangarishtas prepared using the seeds of both these plants showed significant anthelmintic activity in vitro and anti-hyperlipidemic in pre-clinical models.

The Sarivadyasava samples prepared the original drug *Hemidesmus indicus* and alternative plants viz., *Ichnocarpus frutescensare*, *Cryptolepis buchmanii* and *Decalepis hamiltonii* have also showed pharmacological similarities as they could treat oxidative & heat stress in *Caenorhabditis elegans* and lesion healing in cell based models.

Team Members: Subrahmanya Kumar, Vishnuprasad, Ashwini Godbole, Prasanna Simha



11. Project Title: Human Microbiome Initiative of Select Endogamous populations in India

Relevance: This multi-centric coordinated project is aimed to characterize human gut microbiome in selected 17 endogamous populations in different parts of India. The study also investigates the possible association between specific dosha-prakriti of individuals with their gut microbiome. Association of gut microbiome and identification of microbial markers associated with Prakriti types would help in prevention/minimising diseases linked with microbiome and designing much efficient individualised treatment.

Highlights: Detailed SOPs for Prakriti data collection was prepared. Necessary formats and objective questionnaires were also developed to assess agni (digestion and metabolism) & koshta (physiology of gastrointestinal tract) were also developed. The same were pilot tested & finalized by the experts.

Vernacular versions of formats are developed in Hindi, Marathi, Tamil, Bengali, Telugu, Kannada and Malayalam. They were tested by the Ayurvedic practitioners. All SOP and formats are digitized. Adi-karnataka and Vokkaliga endogamous populations were identified and the recruitment was done for the entire project.

Dosha-Prakriti data collection and analysis of the participants of 12 endogamous populations viz., Kallar (Thanjavur, Tamilnadu), Jaat (Palwal and Ballabgarh, Haryana), Kanyakubj & Chamar (Kannauj, UP), Balti (Hardass & Lato, Jammu& Kashmir), Meitei (Imphal, Manipur), Khasi (Shillong, Meghalaya), Maratha (Vadu, Maharashtra), Bhill (Maharashtra & Gujarat), Adi-karnataka & Vokkaliga (Byata, Karnataka), Banjara (Khammam, Telangana) of IHMI project from different parts of the country is completed. Altogether the Prakriti of about 1200 the individuals was carried out using the software CDAC-AYUSOFT. As per the analysis about 38.8 % of the volunteers are dominated with Vata, 22.6 % with Pitta and 38.6 % with Pitta Dosha.



Focus group discussion with the communities



Prakriti analysis of the participants

List of publications

SK Kukkupuni, S Chawla, CN Vishnuprasad. Ayurvedic digestion recipes—Jal Jeera and Churan. Debasis Bagchi, Sunny E. Ohia (Ed.) 'Nutrition and Functional Foods in Boosting Digestion, Metabolism and Immune. Academic Press 2022, 219-233

Team involved: Dr. Subramanya Kumar, Sanket Sharma, Venkatesh, Chaya Bharati Chandra



12. Project Title: Multi-omic approaches and mass spectrometry based tissue metabolite imaging towards understanding metabolites localisation and metabolic pathways in specific cell/tissues of key medicinal plant, *Dysoxylum binectariferum*.

Relevance: Diverse plant species worldwide produce important medicinal compounds used extensively in curing major human diseases, e.g. cancer. Often, availability is limited, due to low levels in planta and/or coming from biodiversity hotspots. Furthermore, their commercial chemical production is frequently difficult because a) synthesis of their complex skeletal structures are not economic and b) metabolic pathway engineering is currently not feasible because of lack of information on biosynthetic machinery involved. In this current program, focused on identifying the possible genes involved in the rohitukine using a multi-omic approach.

Highlights: Our recent studies on tissue specific distribution of the rohitukine in *D. binectariferum* paved the way for exploring rohitukine biosynthesis through targeted transcriptome sequencing. Targeted metabolite profiling of putative rohitukine and other terpenoids biosynthetic pathways, we identified a list of candidate genes that are likely to be involved in flavonoid, terpenoid and chromone alkaloid pathways. We identified well known upstream genes like PAL, C4H, 4CL and CHI that are known to be involved in flavonoid biosynthesis. We also identified other downstream enzymes like CHS and PKS-III (non-CHS type) that are likely to be involved in chromone ring/naringenin biosynthesis.

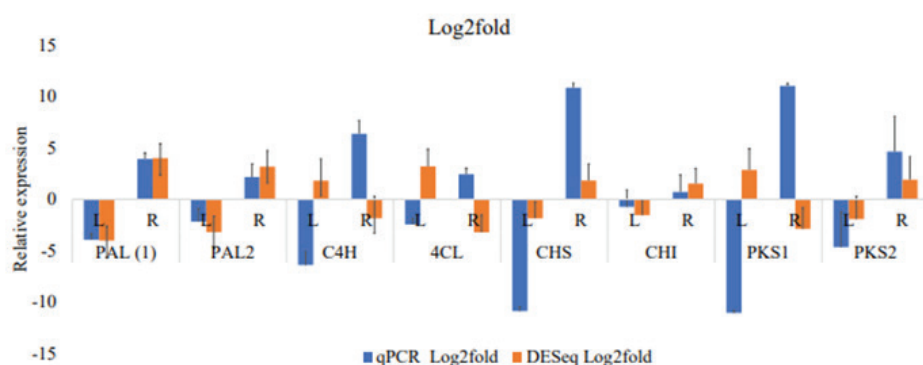


Fig. 1. Expression patterns (log2fold change) of PAL, C4H, 4CL, CHS, CHI and PKS candidate genes involved in flavonoid and chromone alkaloid biosynthesis in root and leaf tissues of *D. binectariferum*



13. Project Title: “Development of sustainable technology for the production of anticancer chromone alkaloids, rohitukine and dysoline from Indian forest trees “BT/PR31331/TRM/120/227/2019]”

Relevance: Chromone alkaloids including rohitukine (Rh) and dysoline have gained enormous attention in recent years for their anti-cancer property. The natural occurrence of rohitukine (Rh) is restricted to only five plant species; *Amoora rohituka*, *Dysoxylum binectariferum*, *D. acutangulum*, (all from the Meliaceae family), *Schumanniphyton magnificum* and *S. problematicum* (from the Rubiaceae family). Among these species, *D. binectariferum* accumulates the highest amount of Rh. Identification of additional new sources of these compounds could contribute to developing a sustainable production technology. Based on above insights, the objective of work involves a) explore for alternative plant species which produce the chromone alkaloids, rohitukine, dysoline and other related compounds, b) develop sustainable production technology for rohitukine and dysoline from the newly identified high yielding sources and c) promote the cultivation of promising sources in agroforestry mode.

Highlights: Identified the elite’s lines/populations for the production of chromone alkaloid, rohitukine. Rohitukine estimation done for different stages of seed and seedling development in *Dysoxylum binectariferum*. Root and leaves produce a higher amount of chromone alkaloid, rohitukine compared to other parts of the tissues.

The chromone alkaloids such as schumagnine, schumannificine, and members of chrotacumins group were identified in *Dysoxylum* and related species. Diversity of chromone alkaloids in species were analyzed statistically (Fig. 1). Pure rohitukine and rohitukine N-oxide were isolated. In *D. binectariferum*, it was observed that rohitukine content was highest in seedling root (2.15 %) and seedling leaf (1.89 %), followed by least observed in pole sized leaves (0.19 %), and adult leaf (0.34 %). The rohitukine is observed highly diverse in Kathgal populations (0.54 %) and NE Manas population (0.44 %), whereas in other population ranging from 0.14% to 0.29 %.

Team members involved: Dr. Mohana Kumara P, Mr. Varun E, Ms. Soumya Bhat, Dr. Jagadish

Table:1 List of equipment’s procured from the DBT project

S No	Name of Equipment
1	Hamilton Syr 25ul (Minor Equipment - Syringe)
2	Cyber Scan pH 700 (Minor Equipment - pH Meter)
3	Eppendorf Research Plus G6 Pack Pipette (Micropipettes)
4	Soxhlet Apparatus-1L (Minor Equipment - Chemical Soxhlet Extraction Unit)
5	Speed Vacuum Concentrator
6	-86C Upright Freezer (Deep Freezer)
7	Shimpack Kits (Minor Equipment - LCMS Column)

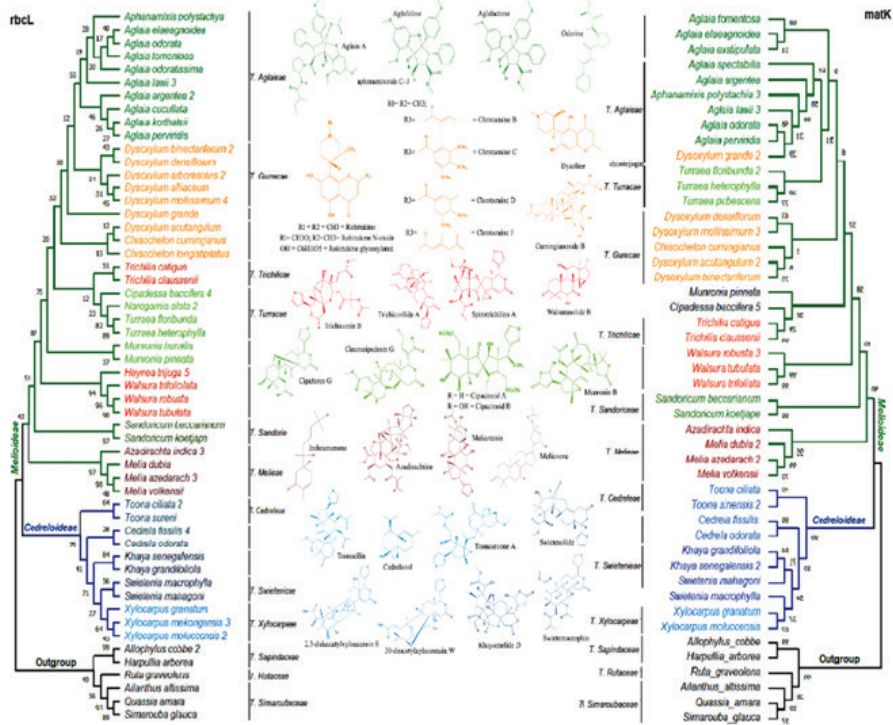


Fig 1. Phylogenetic tree obtained using NJ method in MEGA-X based on *rbcL* sequences and *matK* sequences of Meliaceae species

14. Project Title: “Development of SSR markers and assessment of genetic diversity of natural populations of *Pterocarpus santalinus* L.f. distributed in the Eastern Ghats, India”

Relevance: *Pterocarpus santalinus* L.f. is one of the most valuable plant species found as endemic species in Eastern Ghats of Southern India. Red sanders listed in appendix II of CITES and its export and import is restricted in India. Illegal trading is a major issue in decline of natural populations. Current need for development of specific tools for identification of distinct populations from which the material under trade has been originated. In this current studies we aimed to address a) development of SSR markers using the Next generation sequencing, b) assessing genetic diversity c) identify, if any, population specific markers for *P. santalinus*.

Highlights:

- We performed WGS using illumina platform and obtained the genome assembly from the clean read sequences. From the assembly 282918 SSRs were identified among them 275559 are perfect SSR and 7359 are compound SSRs. We selected 28 SSRs from perfect SSRs for polymorphism analysis across the 52 individuals from three populations of *P. santalinus* from Eastern Ghats of Andhra Pradesh.
- A total of 502 alleles produced from 28 loci, with Polymorphic information content (PIC) from 0.36 to 0.96, with a mean of 0.83, Observed heterozygosity (Ho) 0.42 and expected heterozygosity (He) 0.69. Moderate genetic differentiation among the population was observed based on an Inbreeding coefficient of a subpopulation relative to the total population (FST) (0.19).
- Cross species transferability of *P. indicus* and *P. erinaceus* SSRs were proven successful in *P. santalinus*. In conclusion, we discovered 12 polymorphic primers and 6 cross-species polymorphic primers in *P. santalinus*. These SSRs useful in identification of genetic hotspots, molecular breeding programmes and conservation strategies of *P. santalinus*.

Publications

1. Joshi R.S., Bharti P., Kumara P.M. (2022) Genetic Diversity Analysis of Indian Sandalwood. In: Arunkumar A.N., Joshi G., Warriar R.R., Karaba N.N. (eds) Indian Sandalwood. Materials Horizons: From Nature to Nanomaterials. Springer, Singapore. https://doi.org/10.1007/978-981-16-6565-3_23
2. Mohana Kumara P., Dayanandan S., Vasudeva R., Ravikanth G., Uma Shaanker R. (2022) Population Genetic Diversity of *Dysoxylum Binectariferum*, an Economically Important Tree Species of the Western Ghats, India. In: Kumar A., Choudhury B., Dayanandan S., Khan M.L. (eds) Molecular Genetics and Genomics Tools in Biodiversity Conservation. Springer, Singapore. https://doi.org/10.1007/978-981-16-6005-4_12

Team Involved: Dr. Mohana Kumara P, Ms. Sneha, Ms. Madhshree, Dr. H. R. Prabuddha, Dr. B. N. Divakara

15. Project Title: Stabilization of fats (ghee and oil) by natural antioxidants

Relevance: In India, ghee and 6 oils (sesame, sunflower, mustard, groundnut, coconut, and safflower) are commonly consumed fats. During processing fats are subjected to heat which leads to Rancidity. Rancidity or oxidation of fats is a degradation process of fats. Oxidation can be prevented or delayed by adding antioxidants. Synthetic or natural or combination of both natural and synthetic are used commonly in the food industries. Bhaishajya Ratnavali is an Ayurvedic texts that has mentioned about 'Murchana' a natural method to stabilize the fats using herbs. The study is intended to check the efficacy of natural method of stabilization by Murchana method.

Highlights: Rancidity of ghee is oxidation of free fatty acids and triglycerides leading to bad aroma and flavor by making it unfit for consumption. There are two types of rancidity, oxidative and hydrolytic rancidity. Oxidative rancidity of ghee can be analyzed by chemical determinations such as peroxide value, saponification value, and free fatty tests whereas hydrolytic rancidity can be determined by free fatty acid break down time called Induction time. Induction time and shelf life of oils can be measured by rancimat studies. There are many health-related issues associated with consumption of rancid ghee. Hence, stabilizing of ghee using antioxidants becomes a mandatory. The study demonstrated that there are slight and acceptable changes in color, aroma, and flavor of Murchit oil.

- No changes were observed in peroxide value i.e 3.3 and fatty acids value 0.2 indicating that the Murchana process has not reduced the number of free fatty acids available for oxidation in ghee samples. Reduction in peroxide value and fatty acids value in all oil samples were observed, indicating that the Murchana process reduced the number of free fatty acids available for oxidation.
- Rancimat study showed that induction time of Murchit ghee is delayed by 6-fold compared to control and 5-fold compare to standards.
- Rancimat study showed that induction time of Murchit oils is delayed by approximately 2-fold compared to control oil samples.
- This work showed that the Murchana process stabilizes oils from oxidation reaction and also enhances shelf life. Thus, proving that the Murchana as a natural and safe process for oil stabilization.

Regarding report on Academic programs implemented by the center Internship on Food Future

- No of students- 4
- Goals of program – develop a natural stabilization method for fats (ghee/oils)
- Table on faculty involved

Team Involved: Dr Gurmeet Singh, Dr Shridevi Gothe

16. Project Title: Ayurveda Biology understanding of metabolic diseases

Relevance: Effective merger of holistic and reductionist views of biology is imperative in contemporary healthcare. Creating a trans-disciplinary knowledge framework between Ayurveda and modern biomedicine could be the paradigm for the management of chronic lifestyle diseases like diabetes, obesity and liver diseases

Highlights: Gut-centric approach for diabetes management: The human body regulate glucose metabolism through a multi-targeted mechanism with gut playing a central role. Remarkably, in traditional medicine such as Ayurveda, the gut is considered central to disease manifestation and cure. Therefore the plant based therapeutics used in Ayurveda can probably act at different levels on the gut such as digestive enzymes and hormones to exert their biological action. The versatile roles of gut make it an important target for designing innovative holistic strategies for management of metabolic diseases like diabetes and obesity. Gastro Intestinal mediated Glucose Disposal (GIGD), an orchestrated event regulated by various gut derived factors, is emerging as a systemic strategy in diabetes management. A deeper understanding of GIGD and its multi-targeted mode of action could open up novel holistic strategies for maintaining whole body glucose homeostasis and management of diabetes. The team studied 5 important Ayurveda formulations to understand their mechanism of anti-diabetic action, with a focus on GIGD.

- The team showed Nishakatakadi and Vasanthakusumakara, one of the anti-diabetic formulations used in Ayurveda, works through inhibiting digestive enzymes. Network pharmacology analysis showed the multitargeted mode of action of these formulations.
- The team had conducted a multidimensional analysis of retrospective clinical data of patients treated at IAIM with these formulation using artificial intelligence and machine learning tools. The team proposed novel ways of analysing the clinical data of Ayurveda using these advanced tools.

List of publications:

1. Bhavya Vijay, Gurmeet Singh, CN Vishnuprasad, Ashwini Godbole, Subrahmanya Kumar Kukkupuni, Megha, Prasan Shankar, Poornima Devkumar and Darshan Shankar (2022). Breaking silos: can the emerging field of Ayurvedic biology contribute to the advancement of Indian health science. *Current Science*, 122, 251-257
2. SK Kukkupuni, S Chawla, CN Vishnuprasad (2022). Ayurvedic digestion recipes—Jal Jeera and Churan. *Nutrition and Functional Foods in Boosting Digestion, Metabolism and Immune Health*. 219-233. doi.org/10.1016/B978-0-12-821232-5.00012-4

Team involved: Vishnuprasad, Subramanya Kumar, Anjana T, Sania Kouser

17. Title: To test the benefits of Jackfruit365 Green Jackfruit flour in a model animal, *Drosophila melanogaster*

Relevance: Green Jackfruit Flour is a value-added product being sold in the market as Jackfruit 365. Clinical studies have demonstrated that inclusion of this flour in daily diet can help with inflammation during cancer treatment and in diabetes. The company was interested in evaluating its potential for addressing obesity, fertility and gut issues. We used *Drosophila* as a model to test if Jackfruit Flour can mitigate the effects of a high-fat diet, improve fecundity and gut barrier integrity.

Highlights: *Drosophila* tolerated and were able to consume Jackfruit 365.

- No changes in triacylglycerides, a marker for obesity, were observed on a high-fat diet supplemented with Jackfruit 365.
- Replacement of 5% of corn flour, which constitutes 50% of fly media, with Jackfruit 365, was sufficient to elicit a ~40% increase in fecundity.
- Inclusion of Jackfruit 365, did not affect age-related decline in gut barrier integrity.

18. Title: Does exposure to early life malnutrition alter the adaptation of digestive enzymes to later-life dietary excesses? An animal model investigation.

Relevance: India has the world's highest number of malnourished children. Epidemiological studies have shown that early life malnutrition correlates with increased risk for cardiovascular, metabolic and mental ill health. To understand the biology underpinning this societal problem, we are using *Drosophila* as a model animal. Ayurveda considers the gut to be the origin of several diseases. Hence, here we are asking how the gut, specifically digestive enzymes made in the gut, which are crucial for digesting the food we eat, are altered due to early life malnutrition.

Highlights:

- We focussed on three classes of enzymes needed to breakdown macronutrients: amylases (carbohydrate), proteases (protein) and lipases (lipids). We optimised microplate-based assays for the detection of these enzymes in *Drosophila* midgut.
- Remarkably, these enzymes are not well characterised in *Drosophila*. To understand baseline characteristics we measured enzyme activity in males and females, as they aged. This has been completed for protease and amylase. Male midguts have lower levels of activity of both enzymes. Protease activity does not change with age in either sex. Amylase activity peaks in the first 10 days of adult life and thereafter declines in both sexes.
- Next, we measured how early life starvation (ELS) affects the activity of these enzymes. Amylase activity was no different in males and female ELS flies as compared to control. Protease activity was lower in ELS females but similar to control in ELS males. Lipase activity is higher in ELS females. Further studies are ongoing.
- To mimic high-fat, salt and sugar diets, we supplemented *Drosophila* diet with 10% coconut oil, 1% NaCl or 10% glucose respectively. All three caused a major drop in amylase activity, but the decrease was ~90% in ELS males on 10% Glucose. For protease activity, these conditions induced a drop in activity only in ELS females.
- These studies, for the first time, demonstrate that digestive activity can change due to an early life malnutrition event. Importantly, they persist in adulthood despite the animal being on a "normal diet". Further perturbations to enzyme activity manifest in ELS flies on high fat, salt and sugar diet that are sex-dependent.

Team involved: Megha, Sushmitha Sekar, Sonia NB, Vaibhav Wagh, Debashis Rout

19. Program title: Understanding biological effect of Ayurvedic Nootropics

Mode of Action studies: *Caenorhabditis elegans* models

1. Correlation of aging and nervous system function. Effect of Ayurvedic anti-aging formulation
2. Study of mode of action of Ayurvedic Nootropic formulation on protein homeostasis and neurodegeneration in Alzheimer's and Parkinson's Disease models of *C. elegans*
3. Effect of different dosage forms of Brahmi on neuronal health and Disease
4. Molecular and cellular insights in correlation of sugar and lipid homeostasis with nervous system function

Clinical studies: Effect of Brahmi ghrita on memory

(In collaboration with Centre for Clinical Research, TDU)

1. Age-related Cognitive Impairment (CI): A community based clinical research done in collaboration with a team from NCBS-TIFR
2. Chemotherapy Induced Cognitive Impairment (CICI) in breast cancer patients: In collaboration with HCG, Bangalore

Relevance: Nervous System Health

Optimum development, function and structural integrity of nervous system are of high importance for good quality of life. Good sensory and motor functions as well as high cognition are indication of healthy nervous system.

Aging is the most common factor which leads to decline in cognitive health, but stress, unwholesome life style and injuries can also affect the nervous system health and cognition. Maintenance and enhancement of cognition is very vital not only for fulfilling all the required mental and physical tasks at all ages, but also for reducing risk of getting age-related neurodegenerative disease (Blagosklonny, et al 2009) and enhancing quality of life.

Paucity of effective and safe nootropic drugs

Function of nervous system is an important topic of bio-medical research. Scientific research in recent past has come up with detailed understanding of structural details of normal and diseased nervous system, brain in particular (Bossy-Wetzel et al 2004). However, very few well researched solutions are available for enhancement and maintenance of health of the nervous system.

Ayurveda has concepts and elaborate description of different aspects of nervous system health and disease (Susruta Sutrasthana 2/3, Charaka Samhita VS 8/8). It describes many concepts and suggests many practices, diet, herbs and formulations for enhanced cognition, sensory and mechanical abilities. However, both the concept and practices from Ayurveda are largely not backed up by contemporary scientific evidence (Singh and Rastogi 2012). This has led to limited acceptability and use of potentially very effective health solutions from Ayurveda.

Highlights:

- Mandookaparni swarasa (fresh juice) (Figure 1) and Bala in the form of Ksheerabala 101 protects PD models of *C. elegans* against MPP+ iodide induced neurodegeneration (Figure 1 attached).

- Plain Ghrita (cow ghee) and Brahmi Ghrita have reduces percentage of Amyloid beta protein aggregation induced paralysis in AD models of *C. elegans*. Our molecular biology related experiment (quantitative RT-PCR) indicate that ghee-based formulation and some fat rich food protect AD phenotypes in the transgenic worms by enhancing expression of protein homeostasis and anti-aging genes
- Milk supplementation of food increases life span of *C. elegans*

Team involved: Dr. Ashwini Godbole, Mr. Anjaneyulu J, Dr. Varghese Thomas, Vaibhav Wagh, Debashis Rout, Ms. Ashwini Thakare, Mr. Prasanna K Simha, Mr. Pushpendra Jat, Dr. Swathi G H, Mr. Arman Deep Singh, Dr. Bhaktee Dongaonkar (NCBS-TIFR)

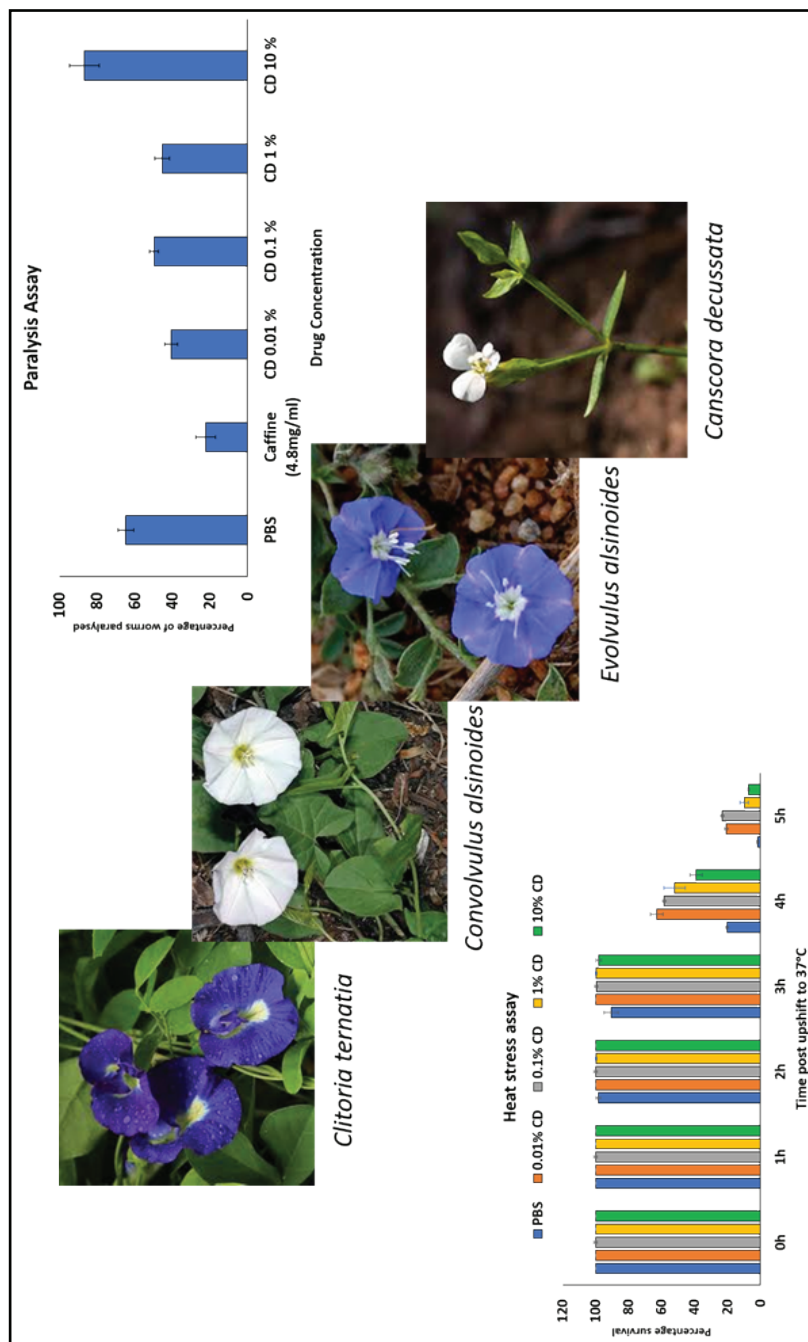
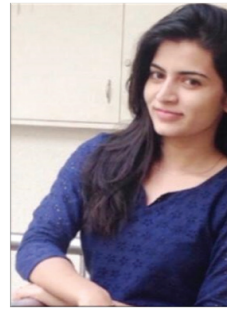


Figure 1. Mandookaparni swarasa (fresh juice)

Sl. No.	Title of the project/ program	Nature of Research	Place of work implemented	Principal Investigator	Industry-Academia-Government-other country Collaboration Activities	Self-funded/ Funding agency (Industry)	Key achievements
1.	Effect of Ayurvedic Nootropics on cognitive function in breast cancer patients on adjuvant chemotherapy: A randomized controlled trial	Clinical Research	TDU, IAIM and HCG Hospitals	Ashwini Godbole		AYUSH-EMR Scheme	<ol style="list-style-type: none"> Objective assessment of cognitive alterations in breast cancer patients. Preliminary results indicating enhancement of cognition in the trial participants consuming Brahmi Ghrita
2.	Pratiksha Trust Faculty Funding	Experimental and Clinical research	TDU	Ashwini Godbole	NCBS, IAIM	Pratiksha Trust	<ol style="list-style-type: none"> Brahmi formulations have positive effect on cognition and related factors- observation from clinical and experimental studies Investigations at molecular level indicate general anti-aging (Rasayana) and stress relieving effects of Ayurvedic nootropics (Medhyarasayana)





Centre for Ayurveda Biology and Holistic Nutrition Team

Title: Regarding report on Academic programs implemented by TDU

Title of degree : M.Sc Life Sciences (Ayurveda Biology)

No of students : 14

Goals of program : To develop a cadre of next-generation young scientists with technical capability to combine the systemic and molecular perspectives of Ayurveda and Biology, to solve problems of today and tomorrow in frontier areas of life sciences

Feedback of students :

Photographs of teaching learning process:

Course related activities: Invited lectures: 10 (National and international speakers)
Weekly debate and discussion on topics related Transdisciplinary research in Ayurveda Biology
Experiential learning through hands-on laboratory training, field visits and workshops (Photos attached)

Faculty involved

1	Dr. C. N. Vishnuprasad	Program Coordinators
2	Dr. Megha	
Sl. No	Name of faculty	Topic taught
1	Dr. Abdul Kareem	Principles of Conservation of Biodiversity
2	Dr. Ashwini Godbole	Cell biology and cell signaling
3	Dr. Atul Kumar Gupta	Principles of Conservation of Biodiversity
4	Dr. M.N.B Nair	Medicinal plants and pharmacognosy, Medicinal plants and pharmacognosy lab
5	Dr. Chethan	Ecological Principles
6	Dr. Datchanamoorthy	Medicinal plants and pharmacognosy lab
7	Ms. Deepa GB	Ecological Principles
8	Dr. Girish Kumar	Fundamentals of Ayurveda, Medicinal plants and pharmacognosy.
9	Dr. Lavanya	Molecular Biology and Genetics, Genomics and Bio-informatics
10	Dr. Kumar SK	Fundamentals of Ayurveda
11	Dr. Megha	Biochemistry, Basics of Plant and Animal Physiology, Biochemistry and Molecular Biology lab
12	Dr. Mohana Kumara P	Basics of Plant and Animal Physiology, Biochemistry and Molecular Biology lab
13	Dr. Noorunnisa Begum	Medicinal plants and pharmacognosy, Medicinal plants and pharmacognosy lab
14	Mr. Patturaj	Medicinal plants and pharmacognosy lab
15	Dr .Pavithra	Genomics and Bio-informatics
16	Dr. B.N.Prakash	Local health traditions and community health

17	Dr. Prasanna Koti	Computational Biology, Genomics and Bio-informatics
18	Dr. Saha	Ecological Principles
19	Dr. Subrahmanya Kumar	Fundamentals of Ayurveda, Integrative Immunology, Medicinal plants and pharmacognosy
20	Dr. Venugopal	Fundamentals of Ayurveda
21	Dr. C. N. Vishnuprasad	Cell Biology, Integrative Immunology, Biochemistry and Molecular Biology lab



Ayush Day celebrations



Bioinformatics Workshop with IBAB



Taxonomist in the field with students – BR Hills



Taxonomist in the field with students – BR Hills



Field Visit to Savandurga

2. Centre for Clinical Research and Education

Sl. No.	Title of research/outreach/ education projects implemented in 2021-22	Source of funding	Team members associated with each project
1	Systems Biology approach to delineate molecular signatures of Prakriti in healthy humans	AYUSH-CCRAS	Dr. Poornima Devkumar, Dr. Satish Rao, Ms. Bhavya V, Ms. Gargi Saha, Dr. Vishnuprasad, Dr. Ashwini Godbole
2	An exploratory pilot study to evaluate the effects of Ayurveda and yoga health practices on Swasthya (wellness) of the health seekers with special reference to respiratory health	B O S C H - I n d i a Foundation-CSR, Bengaluru	Dr Poornima, Dr Prasan, Dr Prashanth, Dr Neelambika, Dr Yashaswini, Dr Srilatha, Dr Sahana, Dr Vikram, Dr Rashel, Ms. Bhavya along with other team members from CLHT, CABHN, CTKDSI of TDU.
3	Ayurveda management of acne (Mukhadooshika/ youvnapidika) – A	-	Dr. Poornima Devkumar, Dr Sahana Ms. Bhavya V, Ms. Gargi Saha
4	Certificate course in “Panchakarma therapy & Yoga basics”, a 6-months residential therapist training program	Odisha Skill Development Authority (OSDA)	Dr Girish Kumar, Dr Deepti, Dr Sreeja Dr Yashaswini, Mrs Nalini, Ms Tarika Ms Bhavya, Mr Ajay



Dr. Poornima



Dr. Satish Rao



Dr. Ashwini



Dr. Vishnuprasad



Ms. Bhavya



Ms. Gargi



Dr. Prasan



Dr. Sahana



Dr. Yashaswini



Dr. Neelambika



Dr. Vikram



Dr. Rashel



Dr. Prashanth



Dr. Srilatha



Dr. Girish Kumar



Dr. Deepti



Ms. Tarika



Dr. Sreeja



Mr. Ajay



Dr. Poornima with the Director General- CCRAS, Dr Rabinarayan Acharya and other Investigators of the project from JNU and ICGEB in the presence of Prof. Bhushan Patwardhan during the signing of the MoU of the project “Systems Biology approach to delineate molecular signatures of Prakriti in healthy humans” at Global Ayush Investment & Innovation Summit, Ahmedabad, Gujarat, 20th April 2022

2. Highlights of selected research/outreach projects from the table above

2.1 Systems Biology approach to delineate molecular signatures of Prakriti in healthy humans

Relevance (scientific/social) of project:

Ayurveda classifies individuals into 7 specific types of Prakriti based on dosha composition. Understanding the physiological attributes of tridosha may help us understand the disease susceptibility. Exosomes are multivesicular bodies which are used as biomarkers due to their specificity and availability in various biofluids. In this study, we will characterize the urine exosome profiles from healthy male individuals (n=294) identified across India belonging to 7 prakriti types classified by Ayurveda. The study will identify biomarker relevance of prakriti categories phenotypically classified at two time points Uttarayana and Dakshinayana. Based on the biomarker profiles, biological pathways will be correlated to the disease profiles to determine the disease susceptibility.

Highlights of progress/ achievements of projects/programs:

The research fellows were recruited. The equipment purchase process for ultracentrifuge, -80 deep freezer, and workstation unit has been done. The protocol of testing is being standardized. A demo regarding sample collection and storage was given by the CCRE team to train the project collaborators from various CCRAS centres. Awaiting the samples from CCRAS centres for exosome profiling.

2.2 An exploratory pilot study to evaluate the effects of Ayurveda and yoga health practices on Swasthya (wellness) of the health seekers with special reference to respiratory health

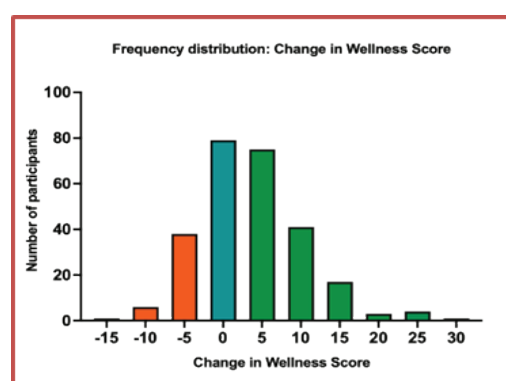
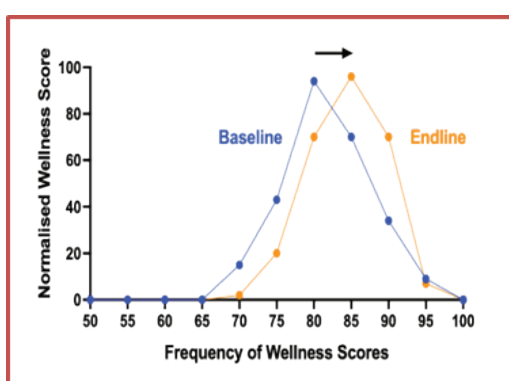
Relevance (scientific/social) of project:

Ayurveda defines wellness by the term Swasthya, a multifactorial homeostasis. An individual with a balanced homeostasis, diet and lifestyle practices is less prone to diseases and illness. However, such awareness about wellness practises, diet and balanced lifestyle is lacking. In this study, a total of 278 male and female apparently healthy individuals from 5 villages in Bidadi were recruited. The effect of Ayurveda and yoga-based health practices implemented through an ecosystem in improving wellness of the health seekers was evaluated. This was a TDU-IAIM programme sponsored by BOSCH in which CCRE, CLHT, CABHN, and CTKDSI from TDU were involved.

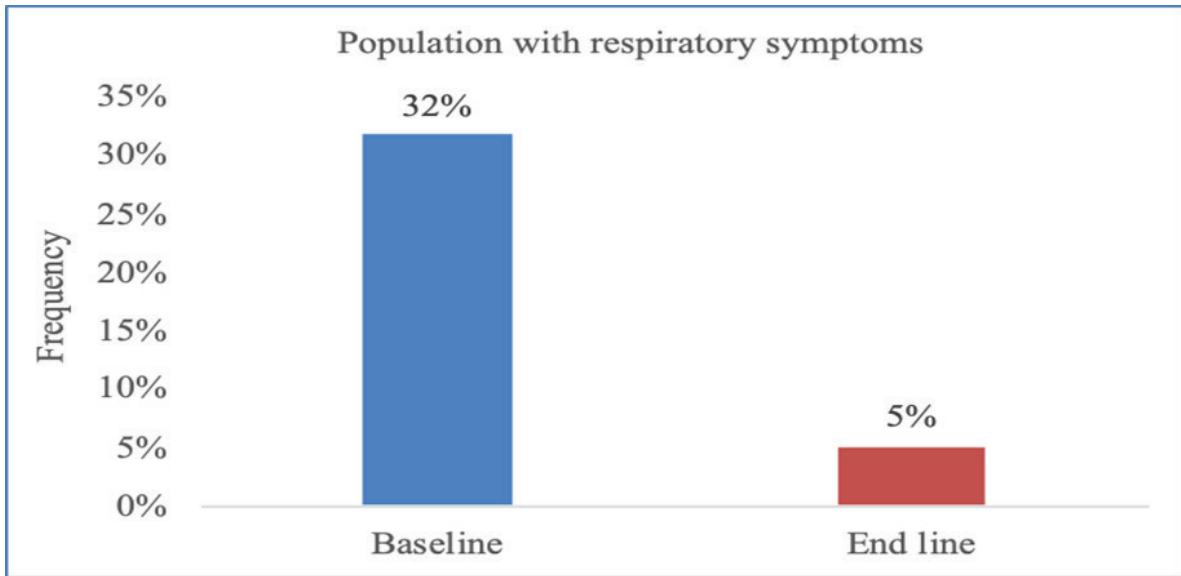
Overall project details are shared by CLHT centre. CCRE highlights the clinical aspects of the study.

Highlights of progress/ achievements of projects/programs:

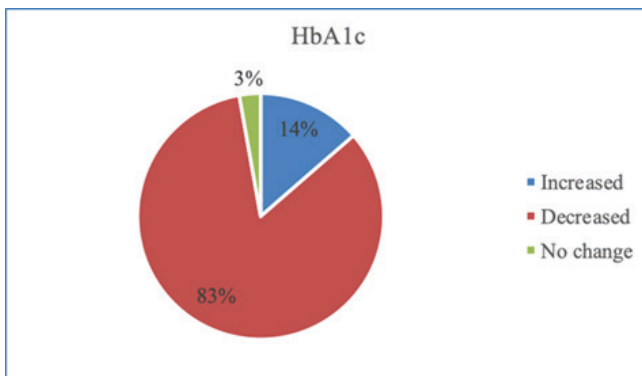
A Total of 278 apparently healthy volunteers were enrolled. Evaluation of their Prakriti, wellness (a validated questionnaire-based assessment), respiratory health, Quality of Life, various lab investigations, Bone mineral density test, Body oxygen level test (BOLT) and 6-minute walk test were done at baseline and endline. Diet and lifestyle advise that also includes yoga along with Ayurveda based intervention that consists of Kshamatva kashayam (herbal decoction powder), anu thailam for nasal application and tilataila gargling for everyday usage was advised for 6 months. 250 participants completed a total of 2 on-site follow ups and one online consultation in the span of 6 months. At the end of the study, pre-post statistical analysis was performed on various laboratory parameters and outcome measures. It was observed that this holistic intervention has improved the wellness of the participants in 68% of people and has improved respiratory health in 84% who had respiratory health issues earlier, HbA1C was reduced in 83%, Haemoglobin improved in 69% of the participants and endurance in terms of improvement in 6 minutes' walk test in 62% of people which were the significant positive response to the programme.



68% of the participants improved their wellness scores through this programme

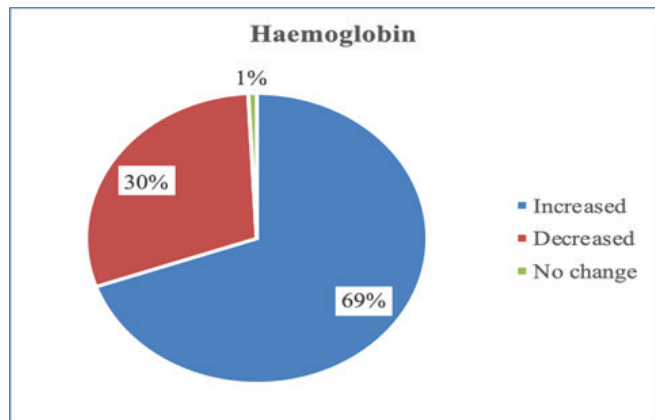


84% with respiratory issues reported Improved respiratory health at the end of the programme



Reduced HbA1c in 83% of population indicating improved sugar metabolism

Improvement of Hb% in 69% of the participants



2.3 Ayurveda management of acne (Mukhadooshika/ Youvnapidika) – A retrospective study

Relevance (scientific/social) of project:

Acne vulgaris is a disease of the pilosebaceous unit, afflicting more than 80% adolescents and young adults and can last into adulthood. The mainstay of acne therapeutics is topical and /or oral modalities comprising mainly comedolytics and antibiotics in the contemporary biomedicine. Ayurveda recommends various internal and external medications along with therapies for the management of acne for a holistic treatment. Though clinical experience of Ayurveda physicians suggests the potential of Ayurveda management of acne, there are still lacunae in terms of systematic evaluation of the whole system Ayurveda in acne management. As a preliminary step towards this, a retrospective study was conducted to study the details of acne cases treated at IAIM during the period of 2010-2017.

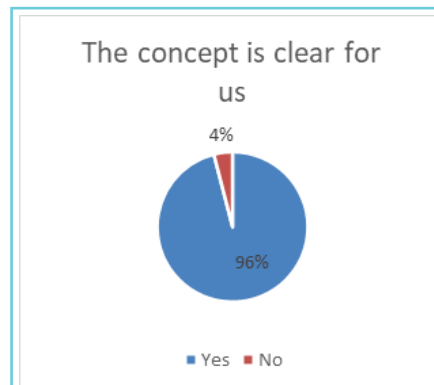
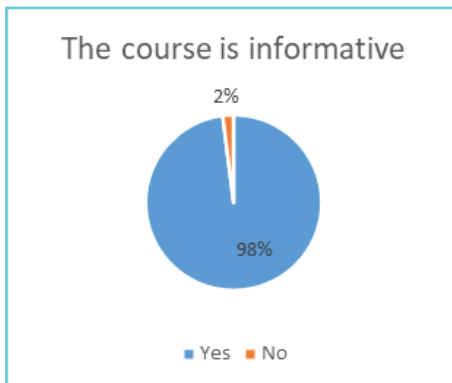
Highlights of progress/ achievements of projects/programs:

Total of 247 patients' data diagnosed with mukhadooshika/ ypuvanapidika ~ acne was collected for analysis. Parameters like gender, age, marital status, blood group, occupation, Medical History, complaints, diet and lifestyle (Ahara, Nidra, Vihara, Vyayama etc), Classification of acne were analysed along with treatment details.

Among 247 patients, 178 were female and 69 were male candidates. Kaphapitta-pittakapha manifestation was predominantly observed (52%), followed by tridosha involvement (13%) and other combinations. Nodular type of acne was the most commonly observed acne at IAIM (10%) followed by other type of acne like pustular, papular, and other combinations comprised rest of the classifications. The data is being analysed for treatment and formulations along with an effort to evaluate the outcome effect. This study analysis gives us an idea of the most common formulations that are being used as both internal medication and external applications in successful management of various kinds of acne at IAIM.

3. Report on Academic programs implemented by CCRE.

- i. Title of degree/ diploma / certificate program
 - 1. Certificate course in “Panchakarma therapy & Yoga basics”, a 6-months residential therapist training program
- ii. No of students: 74 students
- iii. Goals of program
To train the students in skills of panchakarma therapy for employment opportunities in various Ayurveda & wellness establishments
- iv. Feedback from the students on the course.



Few of the students have suggested to arrange more classes on the subjects Dravyaguna, Bhaishajya Kalpana and anatomy that will be implemented.

v. Photographs of teaching-learning process:



vi. Faculty involved in education programme

Sl. No	Name of faculty	Topic taught
1	Dr. Girish Kumar V	Medicinal plants, Bhaishajya kalpana
2	Dr. Sreeja	Panchakarma
3	Dr. Deepthi	Fundamentals of Ayurveda
4	Dr. Yashaswini G	Basic Anatomy
5	Ms. Nalini	Yoga basics
6	Ms. Tarika	English language
7	Ms. Bhavya	Soft skills
8	Mr. Ajaya Goswami	Therapy trainer

3. Centre for Conservation of Natural Resources

Sl. No.	Title of research/outreach/ education projects implemented in 2021-22	Source of funding	Team members associated with each project
1	Revisiting of 7 Medicinal Plants Conservation Areas in West Bengal	West Bengal Forest Department	Dr. K. Ravikumar, Dr. S. Noorunnisa Begum, Dr. N. Dhatchanamoorthy, Mr. Arun
2	Development of an electronic database on medicinal plants of Andaman and Nicobar Islands	NMPB, New Delhi	Dr. K. Ravikumar, Dr. S. Noorunnisa Begum
3	Study of Galls of Karkatashringi	Dabur India Pvt. Ltd.	Dr. S. Noorunnisa Begum, Mr. Patturaj
4	Prioritization of Wild Medicinal Plant Species of Chhattisgarh for Guiding Conservation Action at the State Level through Conservation Assessment and Management Prioritisation (CAMP) Workshop Using IUCN Red List Categories and Criteria ver. 3.1	Chhattisgarh State Biodiversity Board	Dr. K. Ravikumar, Dr. Abdul Kareem, Dr. Suma Tagadur, Dr. S. Noorunnisa Begum, Dr. N. Arun Kumar, Ms. Manasvi, Mr. Patturaj
5	National Mission on Biodiversity and Human Wellbeing: Medicinal Plants	Office of Principal Scientific Advisor	Dr. M. Abdul Kareem, Nishanth G., Mr. Naresh
6	Preparation of People's Biodiversity Register of 13 Villages of Achanakmar Tiger Reserve Chhattisgarh	Chhattisgarh State Biodiversity Board	Dr. M. Abdul Kareem, Amrita G., Ravi T, Nishanth G
7	Conservation Assessment and Management Prioritization (CAMP) process using IUCN Red list categories and criteria for Medicinal Plants of the Union Territory of Ladakh	UNDP	Dr. M. Abdul Kareem, Dr. T.S. Suma, Dr. K. Ravikumar, Mr. Arun
8	Preparation of PBRs of Chikkaallapura, Doddaballapura, Devanahalli and Mysore districts of Karnataka.	Karnataka State Biodiversity Board	Dr. M. Abdul Kareem Ms. Amritha, Mr. Nishanth
9	Training of Trainers (ToTs) and Community Level Training programmes on Sustainable Harvesting of Wild Medicinal Plant Resources in Karnataka	National Medicinal Plants Board (NMPB), New Delhi	Jagannatha Rao, Deepa GB and Arthur Selwyn Mark
10	Resource Augmentation of selected RET and High Traded Medicinal Plant species Covering 22 JFMCs in 18 Forest Divisions of Karnataka, India	Karnataka Forest Department under National Medicinal Plant Board project	Jagannatha Rao and Deepa GB

Sl. No.	Title of research/outreach/ education projects implemented in 2021-22	Source of funding	Team members associated with each project
11	Strengthening NTFP and Ecotourism Value Chain in Thiruvananthapuram Landscape, Kerala	Forest PLUS 2.0 program of Tetra Tech ARD under USAID and MoEF & CC programme	Jagannatha Rao, Arthur Selwyn Mark and Deepa GB
12	Development and standardization of semi-processing technology to enhance the quality and market value of selected medicinal plants in Peechi Wildlife Sanctuary and Silent Valley National Park, Kerala	NMPB-RCFC, Kerala	Jagannatha Rao and Arthur Selwyn Mark
Projects within the Centre			
13	Revitalization of MPCA and MPDA program- Review of the progress and conservation status of MPCAs and Guidelines for strengthening the Program	National Medicinal Plants Board, Govt. of India, New Delhi	Somashekhar B S, PI Noorunnisa Begum, Tabassum Fathima, Sathya Sangeetha, Naresh NK
Institution level Projects			
14	Facilitating BMCs in Education, Awareness and Skill Development and Preparation of People's Biodiversity Registers (PBRs) in Haryana State	Haryana State Biodiversity Board, Haryana	Somashekhar B S, PI Atul Kumar Gupta Chetan H C (April-Sept 22) Ranjith (April-Sept 22)
15	One-week Refresher training course for the officers of Indian Forest Service (IFS)	Ministry of Environment, Forest and Climate Change, Govt. of India, New Delhi	Somashekhar B S, PI Atul Kumar Gupta Naresh NK

Project 1: Revisiting of 7 Medicinal Plants Conservation Areas in West Bengal

Relevance: The study involves re-visiting 7 MPCAs in West Bengal, which were established during 2000 to 2005. The field work focused on studying the wild populations of threatened medicinal plants, and short listing of species for threat assessment at the State level and conducting CAMP exercise, followed by ground truthing.

Highlights of progress/ achievement

Totally 2112 medicinal plant species were recorded in the MPCA network. The project was completed and in Bonnie CAMP in-house team collected in Bonnie CAMP: 96 species, Garpanchkot MPCA: 329 species, N. Rajabhatkhawa MPCAs: 340 species, North Sevoke: 343 species, Sustruti MPCA: 387 species and Tonglu MPCA: 304 species.

Threatened medicinal plant species such as *Piper lonchites*, *Chonemorpha fragrans*, (Sevoke MPCA); *Piper attenuatum*, *Piper betleoides*, *Aristolochia tagala*, *Chonemorpha fragrans* (Susruti MPCA); *Piper sylvaticum*, *Chonemorpha fragrans* (NRKV MPCA) were reported.

Three angiospermic taxa, *Ixora anthroantha* Bremek., *Psychotria erratica* var. *pedunculata* Hook.f. (Rubiaceae) and *Peliosanthes violacea* var. *minor* Baker (Asparagaceae) have been collected from the North Sevoke MPCA. These form first record of occurrence for the state of West Bengal.

Team Members: Dr. K. Ravikumar, Dr. S. Noorunnisa Begum, Dr. N. Dhatchanamoorthy, Dr. Dhatchanamoorthy N

Project 2: Development of an electronic database on medicinal plants of Andaman and Nicobar Islands

Relevance: The database of medicinal plants of Andaman and Nicobar Islands will be useful to understand the available medicinal plant resources for the purposes of research and conservation action programs.

Highlights of progress/ achievement

The team added 300 species as addition to the database reported in the ethnobotanical publications. The photo galleries on taxonomical important species, endemic species, threatened species and important medicinal plant species were added into the database. The website has been developed and completed the testing phase.

The ecological data analysis was completed and technical report was submitted to NMPB.

Team Members: Dr. K. Ravikumar, Dr. S. Noorunnisa Begum, Dr. N. Arun Kumar

Project 3: Study of Galls of Karkatashringi

Relevance: *Pistacia chinensis* subsp. *integerrima* (J. L. Stewart ex Brandis) Rech. f. belongs to family Anacardiaceae; a dioecious tree; native to Asia; widely distributed in East Afghanistan, Pakistan, North West and West Himalaya. In India, it is called by different names such as kakra, kakar singhi, Karkatashringi. It is an important medicinal plant used in Ayurveda and other Indian systems of medicine. The horn shaped galls on leaves and petioles are traded. There has been fluctuation and decrease in gall formation due to the demand of the herbal industries and local healers.

This project aims to study the distribution of Karkatashringi. To study the factors affecting the gall formation and to understand the bottleneck in galls production.

Highlights of progress/ achievement

The karkatashringi trees were tagged and the developmental studies through anatomy was done and the differentiation at the tissue level in young galls, intermediate and mature galls were studied. The comparative observation is presented below:

Table 1: Microscopic character three developmental stage of galls				
S. No	General characters	Young	Intermediated	Mature
1	Epidermis Air	Single layers, teeth like cells	Single layers, thick teeth like cells	Single layers, thick elongated cells
2	Epidermis lumen	Single layer elongated cells	Single layer broad elongated cells	Single layer broad rounded cells with tannin.
3	Parenchymatous	Rounded with polyphenols inclusions	Broad rounded & elongated cells with polyphenols inclusions	rounded & elongated cells with polyphenols inclusions
4	Vascular Bundles	Two rows, collateral, more developments upper layers	Two rows, collateral, more developments upper layers	Two rows, collateral, more developments lower layers
5	Crystals	Druses and prism shaped	Present	Only in below upper epidermis parenchyma cells
6	Starch Grains	All the parenchymatous cells	In-between vascular bundles parenchymatous cells	Absent
7	Secretory Ducts	Presence of Phloem region	Present	Below the rows board size

In the last five years of field work, the tagged trees showed good growth of galls and in certain locations the galls were aborted. The comparative anatomy of mature and aborted galls were done. The characters observed are presented below:

S. No	General characters	Mature	Aborted
1	Epidermis Air	Single layers, thick elongated cells	Single layer, cells are suberized and thick cuticle
2	Epidermis lumen	Single layer, broad rounded cells with tannin.	Board rounded and elongated cells with abundant of Tannin.
3	Parenchymatous	Rounded & elongated cells with polyphenols inclusions	Rounded & elongated cells with phenolic compounds and abundant Tannin
4	Vascular Bundles	Two rows, collateral, more developments lower layers	Two rows, collateral and more developments in upper layer of the vascular bundles.
5	Crystals	Only in below upper epidermis parenchyma cells	Present
6	Starch Grains	Absent	Absent
7	Secretory Ducts	Below the rows huge size	Both rows are huge size.

Project 4: Prioritization of Wild Medicinal Plant Species of Chhattisgarh for Guiding Conservation Action at the State Level through Conservation Assessment and Management Prioritisation (CAMP) Workshop Using IUCN Red List Categories and Criteria ver. 3.1

Relevance: This work will help Forest Department of Chhattisgarh and their Research organizations, to undertake Management interventions for in-situ conservation of taxa identified by experts, including field research for identifying genetic hot spots of the species in their range of natural distribution.

Highlights of progress/ achievement

Conducted two 1-day Pre-CAMP workshops, one at Khondra (Bilaspur) on 1st September, 2021, and another at Kawardha (Raipur) on 2nd September 2021. During the deliberation, 79 shortlisted species were presented providing the details of authentic images and possible names in local languages to Vaidyas and Foresters.

Planned and conducted a 3-day Conservation Assessment and Management Prioritisation (CAMP) Workshop for the medicinal plants of Chhattisgarh at Aranya Bhavan, Nava Raipur, Attal Nagar, Raipur, Chhattisgarh between 23rd and 25th November 2021.

A total of 97 participants attended the workshop. Around two third of participants (61) were subject experts like botanists, taxonomists, etc., medicinal plants user groups like herbal industries and representatives of tribals. The remaining 36 participants were frontline forest staff, People's Biodiversity Register (PBR) volunteers, students who were in the workshop as observers.

Of the 44 taxa assessed, 4 have been assigned as **Critically Endangered (CR)**, 13 as **Endangered (EN)**, 18 as **Vulnerable (VU)**, 7 as **Near Threatened (NT)**, 1 as **Least Concern (LC)** and 1 as **Data Deficient (DD)**.

Team Members: Dr. K. Ravikumar, Dr. Abdul Kareem, Dr. Suma Tagadur, Dr. S. Noorunnisa Begum, Dr. N. Arun Kumar, Ms. Manasvi, Mr. Patturaj

List of publications during 2021-22

1. Ashutosh Sharma*, Nidhan Singh, D.D. Rawat & S.D. Sharma. 2021. *Orobanche cumana* (Orobanchaceae), an addition to the flora of India from Himachal Pradesh (Western Himalaya) with a new host record. *Richardiana* 5: 25 June 2021
<https://richardiana.jardinbotaniquedeguyane.com/wp-content/uploads/2021/06/68-Orobanche.pdf>
2. Harsh Singh, Ashutosh Sharma* & Wojciech Adamowski . 2021. *Impatiens glauca* Hook. f. et Thomson—A little known Himalayan species with augmented escription and a new spurless variety. *Phytotaxa* 539(No 3):280-286 <http://dx.doi.org/10.11646/phytotaxa.539.3.7>
3. Madavath Chennakesavuku Naik, Malisetty Vishnu Priya, Lal Ji Singh and Noorunnisa Begum. 2021. Jointed Buttonweed (*Spermacoce articularis* – Rubiaceae): Addition to the flora of Andaman and Nicobar Islands, India – V. *Indian Journal of Forestry*, vol. 44, Issue 2, Page no. 65-67.
4. Narayanasamy Dhatchanamoorthy, Noorinsha Begum Syed, Kreni Lokho & Natesan Balachandran. 2021. Rediscovery and range extension of the rare species *Diospyros truncata* Zoll. & Mor. (Ebenaceae) in the State of Manipur, northeastern India. *Biodiv. Res. Conserv.* 62: 1-4.
5. Patturaj, R., S. Noorunnisa Begum, K. Ravikumar, P. Sheema Dharmapal; P.S. Udayan. 2021. Anatomical studies on the leaf and stem of *Tinospora formanii* Udayan ; Pradeep (Menispermaceae), an endemic species to Southern Western Ghats, Kerala, India. *Current Botany* 12: 132-137. doi: 10.25081/cb.2021.v12.6455
6. Rajib Gogoi, Wojciech Adamowski, Norbu Sherpa, Ashutosh Sharma & Souravjyoti Borah. 2021. Misinterpretations and plagiarism in a publication about Himalayan *Impatiens*: polemics with the paper of Singh R.K. et al. 2021. *Biodiv. Res. Conserv.* 63: 1-30, 2021
<http://dx.doi.org/10.2478/biorc-2021-0005>
7. Ravikumar, K., Tiwari, U., Balachandran, N. and Arun Kumar, N. 2022. *Tribulus ochroleucus* (Maire) Ozenda & Quezel (Zygophyllaceae) - a new addition to the flora of India. *Journal of Threatened Taxa* 14(3):20805-20807.
8. Sumanth, M. V., Ravikumar, K.; Ravichandran, P. 2021. Taxonomy, Pharmacognosy and Phytochemical Characteristics to Identify the Authentic and Substitute Botanical Sources Used as Agnimantha. *Indian Journal of Traditional Knowledge* Vol. 20(2): 351-357.
9. Seethapathy, G.S., Wold, C.W., Ravikumar, K., de Boer, H.J.; Wangenstein, 201. H.Ethnopharmacology, biological activities and chemical compounds of *Canarium strictum*: An important resin yielding medicinal tree in India. *Fitoterapia* Vol. 152: 104920.
10. Vereena Rodrigues, Amit Kumar, Sivaraman Gokul, Ashutosh K Shukla, Kaliamoorthy Ravikumar, Velusamy Sundaresan. 2021. *Decalepis salicifolia* (Bedd. ex Hook. f.) Venter: A steno-endemic and critically endangered medicinal and aromatic plant from Western Ghats, India. *Journal of Biosciences.* 46: 44.

Talks Delivered

- Dr. S. Noorunnisa Begum delivered online talk on Conservation of Medicinal Plants on 19th August 2021 for Delhi Public School, Bangalore North.
- Dr. S. Noorunnisa Begum delivered online talk on A Glimpse into the Journey of Dr.E.K.Janaki Ammal: Indian Botanist, 18th November 2021 for Visvesvaraya Industrial & Technological Museum, National Council of Science Museum, Ministry of Culture, Govt. of India.
- Dr. S. Noorunnisa was part of online talk on Meet the scientist 8th January 2022 organised by the science community.
- Dr. S. Noorunnisa was part of online talk on “Taxonomic Authentication” as part of Online workshop on Authentication and Traceability of Medicinal Actives from Naturals on 8th Jan 2022 talk
- Dr. S. Noorunnisa was part of online talk on *Medicinal plants diversity in India- highlights on Life forms, botanical families, Endemics, RET species, Traded/ HVT species and Geographic distribution across major biomes and forest types* in the Refresher Training Course for IFS officers on Sustainable development of Medicinal Plants in India’s Forests 21-25 March 2022.

Webinar organised by Herbarium team:

- About five webinars on Indian Ethnobotany were organised covering central indian, western India and east part of the India.
- Webinar on ‘My Journey in the Field of Taxonomy by Dr. N. Dhatchanamoorthy’ was held on 19 March, 2022
- Webinar titled “The Blossing field of Plant Taxonomy’was organised on 19th and 20th March 2022 as part of World Taxonomist Appreciation Day!

Academic programs implemented by the center

Title of the course: M.Sc by Research in Plant Systematics

No. of students: 2

Goals of program: To create a cadre of field taxonomist with in-depth knowledge of identification and modern tools of various discipline to meet the requirement of various sector such as plant systematics, conservation, anatomy, ethnobotany, Quality Control.

Feedback of students: MSc. R Life Science (Plant Systematics by Research) is one of its kind course offered in India where we get the opportunity to learn Plant Systematics from the basics of classical morphological taxonomy and ethnobotany to the advanced modern techniques in Molecular Taxonomy, Ecology and Conservation Assessment.

The biodiversity reach campus including a ethnobotanical garden with about 1500 species from different habitats of India which includes several rare, endangered, threatened and endemic plants give the unique field exposure to students so they get to learn about so many species just at one place. The FRLH herbarium and India’s largest Raw Drug Repository where we learn about herbarium making techniques add more learning experience and value to this course.



Mr. Ashutosh Sharma research area – Khokhan WLS with Rhododendron, Oak and Cedrus forest.



Ms. Manasvi interacting with the Yanadi tribe, Chittoor district, Andhra Pradesh

Faculty involved:

Sl No	Name of faculty	Topic taught
1	Dr. S.Noorunnisa Begum (CCNR)	Plant Taxonomy and Plant Anatomy
2	Dr. Dhatchanamoorthy N (CCNR)	Plant Taxonomy
3	Mr. Patturaj (CCNR)	Plant Anatomy
4	Hariramamurthi G (Centre for Local Health Traditions and Policy-CLHT)	Local Health and Traditions
5	Dr. B.N. Prakash (CLHT)	Local Health and Traditions

Project 5. National Mission on Biodiversity and Human Wellbeing – Medicinal Plants

Relevance: The National Mission on Biodiversity and Human Well-Being, seeks to address some critical challenges that India faces in the domains of public health, agriculture, climate change and disaster risk management, ecological restoration, green and regenerative economies, documentation, sustainable use and conservation of biodiversity. This sub-component will demonstrate a multi-faceted, multi-institutional, multiple stakeholder intervention focused on documentation, conservation and sustainable use of medicinal plants for health and livelihood security of rural communities. Demonstrated a better in-situ conservation approach for targeted medicinal plants, including national and regional herbaria, e-dictionary of plant nomenclature, and extract library. This has illustrated a scalable model of community enterprises for livelihood stability, conducting scientific revalidation of star herbal formulations for human, animal, and crop usage.

Highlights of progress/ achievements of projects/programs:

- The second regional workshop, titled “Regional Workshop on the Potential Applications of the Multi-Faceted Citizens’ Portal on Medicinal Plants for Health, Livelihoods, and Conservation Priorities for Raichur District, Karnataka,” was held on September 25th, 2021.
- Regional workshop (Online) was conducted for the different stakeholders of West Sikkim along with the one-health component on 31st August 2021.
- Designed methodology on National Nomenclature Standards and e-dictionary
- Prepared the inventories of medicinal plants including identification of priority species for Medicinal Plant Conservation Areas (HVT, Endemic and Threatened species) for five states.
- A checklist of medicinal plants used in the Codified system of medicine of National herbarium, which will be focused on during the Mission for collection of accessions for the herbarium.
- Standard trans-disciplinary protocol developed for R & D for value addition. The protocol for herbal drug analysis has been reviewed by experts from Natural Remedies and Himalaya.
- Refined roadmap for the execution of the full- fledged Mission.

Project Team: Prof. Darshan Shankar, Vice Chancellor, TDU (HON), Dr. Atul Kumar Gupta, Chief Operating Officer & Registrar, TDU (HON), Mr. Varun Subramaniam IT Specialist (HON), Dr. Vishu Prasad, Cell Biologist, (HON), Dr. Pavithra, Geneticist (HON), Dr. Kumar Pashu Ayurveda (HON), Dr. Venugopal Ayurveda Database Specialist (HON), Dr. Tabassum Ecologist (HON), Dr. M Abdul Kareem, Head, CCNR, TDU, Mr. A. V. Balasubramanian, Director at Centre for Indian Knowledge Systems, Dr. Chetan HC, Associate Professor, Centre for Conservation of Natural Resources, TDU, Dr. Noorunnisa Begum S Associate Professor, Centre for Conservation of Natural Resources, TDU (HON), Dr. Dhatchanamoorthy N, Assistant Professor Centre for Conservation of Natural Resources, TDU, Mrs. Sangeetha GIS Specialist (HON), Mr. Nishanth Gurav, JRF, CCNR, TDU, Mr. Arun Kumar, JRF, CCNR, TDU, Mr. Naresh NK, Administrative Assistant, CCNR, TDU.

Project 6. Preparation of People's Biodiversity Register of 13 Villages of Achanakmar Tiger Reserve Chhattisgarh

Relevance: The People's Biodiversity Register (PBR) is a mandatory document to be prepared in all levels panchayats in India according to the Biodiversity Act 2002. This is one of the most crucial steps to preserve Traditional Knowledge of communities, recognizing Local Healers and giving them a platform, power and responsibility to manage the local Biodiversity present in the area.

The document can also be used for livelihood creation based on the guidelines of NBA, used to declare Biodiversity Heritage Sites –which can be very beneficial to the region.

Highlights of progress/ achievements of projects/programs:

- The BMC members and community members were familiarized with provisions of the Biological Diversity Act, the concept of People's Biodiversity Register and possible advantages of engaging in the PBR process. Sensitization of the public about the study, survey and possible management was done.
- Training of members in identification and collection of data on biological resources and traditional knowledge was completed based on guidelines of National Biodiversity and using local resources
- Preparation of People's Biodiversity Register (PBR), a preliminary report on 13 Gram Panchayats of Achanakmar Tiger Reserve was submitted to CGSBB
- Computerization of information and creation of a consolidated database in the form of People's Biodiversity Register in the formats specified by the National Biodiversity Authority was completed and submitted to the Biodiversity Board.
- The PBRs were accepted by the Biodiversity Board and were successfully completed in March 2022.

Team members involved: Dr. M. Abdul Kareem, Center head CCNR Nishanth Gurav, Research Fellow, CCNR, Dr Ravi Kumar and Mr. Arun

Project 7. Conservation Assessment and Management Plan for Medicinal and Aromatic plants of Ladakh

Relevance: Ladakh is home to a diverse medicinal flora and rare species. The relentless destruction of wild populations of medical plants has occurred from the over exploitation of medicinal plant resources for use in the pharmaceutical sector. The current study aims to analyse the existing state of knowledge on medicinal plant resources in Ladakh, as well as their conservation status.

Highlights of progress/ achievements of projects/programs:

- Secondary sources such as published floras, books, research papers, and earlier studies were used by the University of Trans-Disciplinary Health Sciences and Technology to identify 62 medicinal plant species of conservation importance.

- On the 11th and 12th of December 2020, an online PRE-CAMP session was held to determine the candidate species for assessment during the CAMP workshop, which was scheduled for September 2021. The specialists added 51 additional species to the list, bringing the total number of species on the working list to 113. Deliberations took place on 113 species, with 55 being selected based on occurrence, population decline, usage, and threat status.
- The CAMP workshop on Ladakh medicinal plants was held in Leh, Ladakh, from September 15th to September 17th, 2021. The workshop which was organized by the Department of Wildlife Protection, Union Territory of Ladakh, Secure Himalaya Project in association with the National Institute of Sowa-Rigpa, Leh, and The Tropicalist, Kargil, as part of the Gol UNDP-GEF Secure Himalaya Project in Ladakh, was the first stage in developing a strategy for the state's medicinal plants' protection and long-term usage as part of the Secure Himalaya Project.
- The participants chose 40 taxa for evaluation from the 57 submitted taxa and added three more taxa for examination through discussion. TDU suggested these 40 taxa after consulting with field specialists and meeting the requirements of being heavily traded, endemic, or phylogenetically unique. Representatives from universities, research institutes, national institutes, the Forest Service, and other participants assessed the proposed species and suggested a few more based on their danger perceptions, after assuring that their population distribution and reduction.
- The 40 taxa were divided into four sub-lists and allocated to four different groupings. 3 taxa were classified as Critically Endangered, 11 as Endangered (EN), 10 as Vulnerable (VU), 11 as Near Threatened (NT), 3 as Least Concern (LC), and 2 as Data Deficient, according to the IUCN Red List Categories and Criteria (DD). These 40 taxa were divided into 21 families and 31 genera. With five species each, the Ranunculaceae and Asteraceae families were the most well-represented, followed by the Berberidaceae and Polygonaceae families.
- For certain species, such as *Lagotis cashmeriana*, an assessment of natural populations was proposed as the initial step in conservation because knowledge on them was scarce. This workshop has raised awareness and garnered attention in the Himalayan and trans-Himalayan medicinal plant riches among academics and practitioners.

Team members involved

Dr. M. Abdul Kareem, Dr. T.S. Suma, Dr. K. Ravikumar, Mr. Arun.

Project 8. Preparation of PBRs of Chikkaallapura district, Mysore District and Chickaballapur, Bangalore ULBs of Karnataka.

Relevance: The People's Biodiversity Register (PBR) is a mandatory document to be prepared in all levels panchayaths in India according to the Biodiversity Act 2002. This is one of the most crucial steps to preserve Traditional Knowledge of communities, recognizing Local Healers and giving them a platform, power and responsibility to manage the local Biodiversity present in the area. The document can also be used for livelihood creation based on the guidelines of NBA, used to declare Biodiversity Heritage Sites –which can be very beneficial to the region. Chikkaballapura, Bangalore rural and Mysore are regions that are filled with the plethora of Biodiversity and consist of natural historical places.

Highlights of progress/ achievements of projects/programs:

- The BMC members and community members of 2 districts, 10 talukas and 6 urban local bodies were familiarized with provisions of Biological Diversity Act, the concept of People's Biodiversity Register and possible advantages of engaging in the PBR process.
- Around 120 vaidyas/Local healers were identified across 2 districts, 10 talukas and 8 urban local bodies and were involved to document data according to the prescribed formats.
- Around 1500 plus flora and fauna species and associated traditional knowledge was recorded in the People's Biodiversity Registers prepared
- The press release of the People's Biodiversity Registers of Bagepalli CMC and Gudibande TMC was completed in the presence of local media newspapers, local news channels, BMC members and relevant stakeholders
- Training of members in identification and collection of data on biological resources and traditional knowledge was completed based on guidelines of National Biodiversity and using local resources
- Field level data was collected by the field experts in 2 zilla panchayat and 10 taluk panchayat and 8 urban local bodies.
- Computerization of information and creation of a consolidated database in the form of People's Biodiversity Register in the formats specified by the National Biodiversity Authority was completed.
- Chickaballapur district and 3 taluk PBRs of Chickaballapur were accepted by the Biodiversity Board and were successfully completed in March 2022.
- 2 Urban PBRs that are Doddaballapur City Municipal Council and Devanahalli Town Municipal Council PBRs were accepted by the Biodiversity Board and were successfully completed in March 2022.

Team members involved: Dr M. Abdul Kareem, Center Head, CCNR, Ms. Amrita, FRLHT, Nishanth Gurav, Research fellow, FRLHT, Arun N, Taxonomist, FRLHT.

List of Publications:

- 11 People's Biodiversity Register of Chickaballapur and Mysore district and its taluk
- 13 People's Biodiversity Register of 13 Villages of Achanakmar Tiger Reserve Chhattisgarh
- A Pre CAMP workshop of Ladakh report
- A CAMP report of report

- Nishanth S. Gurav, Abdul Kareem, Sangeeta Srivastava, N. Dhatchanamoorthy, 2021. Studies on ethno-medicinal plants used by the Gond tribes of Bilaspur district from Chhattisgarh, India, Int.J.Curr.Res.Biosci.Plantbiol. 2021.8(10): 42-47

Regarding report on Academic programs and project implemented by the centre

PhD :

Student I : Ma. Praneetha Paul

Topic : Assessing Ecotourism Potential in Protected areas of Chhattisgarh

Student II : Mr. Rajesh Kallaje

Topic : Analysis of the Implementation of Forest Rights Act in Select Districts of Chhattisgarh

Student III : Mr. Hussain Ebrahim

Topic : Implications of preserving traditional wisdom towards sustainable livelihoods and natural resource management, in context to designing culturally relevant curriculum for children of the indigenous communities

Student IV : Mr. Gurunathan. N

Topic : Studies on Human Elephant Conflict – finding management solutions at Central Eastern landscape of Chhattisgarh

Student V : Dr. Padma Gurmet

Topic : Herbal resources of Ladakh Himalayas and its significance for Buddhist medicine “Sowa-Rigpa”

List of webinars:

1. “Virtual launch of HD Kote Herbal Pharmacopoeia Portal”
2. National Webinar Series, Celebration of World Environment Day June 2021 and Foundation Day of NMNH, New Delhi.
3. Trends & issues in indigenous Maori horticulture systems in the 21st century
4. Launching of MSc Conservation Practices course – TDU- Atree collaboration

Project 9. Training of Trainers (ToTs) and Community Level Training programmes on Sustainable Harvesting of Wild Medicinal Plant Resources in Karnataka funded by National Medicinal Plants Board (NMPB)

Relevance: This project is aimed to complete 5 ToTs and 10 Community Level Training programmes in Karnataka on sustainable harvesting of wild medicinal plants. Protocols on sustainable harvesting have already been developed for 48 species by TDU following international standards for sustainable wild harvest.

Highlights:

- Two ToT programmes, on 1st - 2nd September 2021 and 24th – 25th November 2021 at Mysuru and Hassan respectively were conducted covering 86 trainees who were the Non Timber Forest Produce (NTFP) collectors of Large Scale Adhivasi Multi-Purpose Cooperative Society (LAMPS). Details are given in table 1:
- Five Community level Training programmes were conducted covering 298 medicinal plants collectors. Details are given in table 2:

Table 1: Training of Trainers (ToT) organised under this project

Sl. No.	Training level	Date	Venue	LAMPS covered	No. of trainees attended
1.	ToT	1st and 2nd September 2021	Mysuru	Hunsuru, H.D. Kote, Madikeri, Thitimati	37
2.	ToT	24th – 25th November 2021	Hassan	Hassan, Holenarasipura, Arasikere, Channarayapatna	49
Total					86

Table 2: Community level training programmes organised under this project

Sl. No.	Training level	Date	Venue	LAMPS covered	No. of trainees attended
1.	Community Level	3rd – 4th September 2021	H.D. Kote	H.D. Kote	71
2.	Community Level	20th – 21st September 2021	Hunsuru	Hunasuru	60
3.	Community Level	21st – 22nd September 2021	Basavanahalli	Thitimati	52
4.	Community Level	25th – 26th November 2021	Mudigere	Mudigere	60
5.	Community Level	26th – 27th November 2021	Koppa	Koppa	55
Total					298

Project 10. Resource Augmentation of selected RET and High Traded Medicinal Plant species Covering 22 JFMCs in 18 Forest Divisions of Karnataka, India, funded by Karnataka Forest Department under National Medicinal Plant Board project

Relevance: The main goal of this project is to conserve and restore the gene pool of selected medicinal plants in wild and also to ensure supply of authentic raw material to AYUSH industries in the future. Technical support was provided to Karnataka Forest Department for the plantation activities to raise selected 19 species of medicinal plants through Artificial Regeneration (AR) and Aided Natural Regeneration (ANR) models covering area of 295 ha and 905 ha respectively in 22 Joint Forest Management Committees (JFMCs).

Table 3: List of JFMCs and species planted

Sl. No.	Name of JFMC	Forest Division	Species targeted
1	Jodukatte	Ramanagara	<i>Decalepis hamiltonii</i>
			<i>Asparagus racemosus</i>
2	Agumbe	Shimoga	<i>Garcinia gummi-gutta</i>
			<i>Cinnamomum sulphuratum</i>
3	Illemanji	Shimoga	<i>Ailanthus triphysa</i>
			<i>Myristica dactyloides</i>
4	Honnasagadde	Shimoga	<i>Terminalia chebula</i>
			<i>Phyllanthus emblica</i>
5	Hasirumane	Shimoga	<i>Artocarpus lakoocha</i>
			<i>Garcinia gummi-gutta</i>
6	Siragunji	Honnavar	<i>Salacia chinensis</i>
			<i>Embelia tjsarium-cottam</i>
7	Kaduboranalli	Tumkur	<i>Terminalia chebula</i>
			<i>Pongamia pinnata</i>
8	Baadenahalli	Tumkur	<i>Tamarindus indica</i>
			<i>Pongamia pinnata</i>
9	Chandaguli	Yallapur	<i>Garcinia indica</i>
			<i>Embelia tjsarium-cottam</i>
10	Panchavati	Koppa	<i>Terminalia bellirica</i>
			<i>Murraya koenigii</i>
11	Mallikarjuna	Koppa	<i>Acacia concinna</i>
			<i>Garcinia gummi-gutta</i>
12	Nidle	Mangalore	<i>Acacia concinna</i>
			<i>Piper nigrum</i>
13	Talageri	Honnavar	<i>Garcinia indica</i>
			<i>Sapindus emarginatus</i>

Sl. No.	Name of JFMC	Forest Division	Species targeted
14	Aluru	Haliyal	<i>Terminalia chebula</i>
			<i>Phyllanthus emblica</i>
15	Kalave	Sirsi	<i>Sapindus emarginatus</i>
			<i>Phyllanthus emblica</i>
16	Mahadevanagar	Mysore	<i>Gloriosa superba</i>
			<i>Asparagus racemosus</i>
17	Basavanahalli	Madikere	<i>Phyllanthus emblica</i>
			<i>Acacia concinna</i>
18	Balagunda	Belgaum	<i>Syzygium cumini</i>
			<i>Pongamia pinnata</i>
19	Bandur	Dharwad	<i>Syzygium cumini</i>
			<i>Terminalia bellirica</i>
20	Ayajhapura	Raichur	<i>Azadirachta indica</i>
			<i>Pongamia Pinnata</i>
21	Shamatabad	Bidar	<i>Buchnanian axillaris</i>
			<i>Azadirachta indica</i>
22	Agrahara	Bellary	<i>Annona squamosa</i>
			<i>Syzygium cumini</i>

Highlights:

Facilitated the project review meetings and field visits to the project sites by a team from the Regional Cum Facilitation Centre, National Medicinal Plants Board, Peechi during March 2022.

Publication:

Jagannatha Rao R., Deepa G.B., Suresh H.M. and Arthur Mark Selwyn. 2022. Handbook on species specific guidelines on sustainable harvesting, value addition and nursery & propagation techniques for medicinal plants. Pp 1-113, The University of Trans-Disciplinary Health Sciences and Technology (TDU), Bengaluru.

<https://www.tdu.edu.in/tdusecond/wp-content/uploads/sh-handbook.pdf>

Project 11. Strengthening NTFP and Ecotourism Value Chain in Thiruvananthapuram Landscape, Kerala, funded by Forest PLUS 2.0 program of Tetra Tech ARD under USAID and MoEF & CC programme

Relevance: This project was funded by USAID through Tetra Tech ARD, New Delhi under Forest PLUS 2.0 program. The main objective was to strengthen value chains for identified Non Timber Forest Produces (NTFPs) and promote ecotourism services in Thiruvananthapuram landscape in Kerala. This project aimed to generate livelihoods to women, youth, marginal communities and other vulnerable groups in the landscape especially tribal forest dependent communities.

Highlights:

- Completed report on “Identify target communities and program participants for Cheruthaen beekeeping, present the research and outreach findings and selected species for cultivation and identify VSSs and members for NTFP cultivation piloting”.
- Completed report on “formation of beekeeping groups, potential local food and beverages, and recipes, potential farm & forest-based produces and handicrafts and handlooms for ecoshops”.
- Prepared training modules on “cheruthaen beekeeping training for Master Trainer’s, sustainable harvesting and post harvesting practices for selected NTFPs, cultivation of selected NTFPs, community based ecotourism and nature camp activities”.
- Completed report on “research and Outreach on Sustainable Harvesting and Postharvest Management Practices for NTFPs/Medicinal plants”.
- Prepared final report on trainings programs on sustainable harvesting & post harvesting management practices and, cultivation of for NTFPs/ medicinal plants.
- Finalised research report on “local food and beverages”.
- Prepared and finalised research report on “farm and forest produces, handloom and handicraft items”.
- Prepared report on “setting up of beekeeping piloting Proceedings from Master Beekeeping training, Proceedings from beekeeping training for selected beneficiaries from VSSs/EDCs, Proceedings from one-day training on sustainable harvesting and post-harvest management of select NTFPs and Mobilization of VSSs/EDCs for NTFP harvesting and procurement and supply these NTFPs to Vanasree Value Addition Centre Community-based ecotourism training modules”.
- Finalised report on piloting of cheruthaen beekeeping.
- Prepared a report on linking VSS and community members with industries for buy back arrangements of NTFPs by developing MoU formats.

Publication:

Jagannatha Rao R. and Arthur Mark Selwyn. 2021. Strengthening of NTFP and Eco-tourism value chain activities in Thiruvananthapuram landscape, Kerala. FOREST-PLUS 2.0: FOREST FOR WATER AND PROSPERITY. Pp. 1-2077

<https://www.tdu.edu.in/tdusecond/wp-content/uploads/Forest-Plus-Report.pdf>

Project 12. Development and standardization of semi-processing technology to enhance the quality and market value of selected medicinal plants in Peechi Wildlife Sanctuary and Silent Valley National Park, Kerala, Funded by NMPB-RCFC, Kerala

Relevance: The main objective of this project is to explore the prospects of post-harvest management practices for 14 medicinal plant species and honey in eight Eco-Development Committees (EDCs) in Silent Valley and Peechi, Kerala. Development and standardization of semi-processing and packaging methods to improve the quality of the herbal products for supplying to the herbal industries was also attempted.

Highlights:

- In this project, the selected landscape in Kerala state was Peechi-Vazhani Wildlife Sanctuary and Silent Valley National Park under Wildlife Circle North. Out of 7 Eco-Development Committees (EDCs) in Silent Valley Wildlife Division, five EDCs (Anavai, Thadikundu, Uppukulam, Karuvara and Watchers) were selected for this study. In Peechi-Vazhayani Wildlife Division, out of 12 EDCs, four (Olakara, Kakkinikad, Maniyankinar, Chimmony) EDCs were selected. The selected nine EDCs in Silent Valley National Park and Peechi are located in the buffer zones of protected areas that are rich in natural resources especially NTFPs. Tribal communities in these areas, who are obviously part of the EDC members, totally depend on these resources for their health and livelihood security. NTFPs contribute substantial income to tribal communities in the selected EDCs, as they depend on collection of NTFPs from wild. Species that are under collection by these EDCs have the potential to generate employment and livelihood income to tribal communities besides meeting their health needs.
- In this project, the methods of processing and value addition were developed for both plant parts that are harvested and species-specific for selected 14 NTFPs. Moreover, the processing and value addition methods were for the For harvesting stage, the developed good collection practices cover aspects like what to harvest, what stage to collect, how to harvest, how much to harvest, and when to harvest. For the post-harvest management, the processing methods such as sorting, grading, washing, drying, powdering, oil extraction, etc. were proposed. When it comes to packaging and labeling of processed plant materials, the aspects like what to be packed, how to pack, what to label, etc. were covered. For storage practices, the proposed methods addressed aspects such as what to store, how to store and how long to store, etc. The tools and equipment needed for implementing the developed processing and value addition techniques at local level were worked out. Besides, the requirements of infrastructure facilities and skilled labour were also detailed.
- Prepared final technical report and submitted to the funding agency. With this, the project is completed and delivered the targeted deliverables.

Table 4: The details of 14 species prioritised are given below:

No	Species	Parts collected	Medicinal / commercial use
1	Kunthirikkum <i>Canarium strictum</i>	Resin	Sambrani or Dammer or dhoopa; Aromatic
2	Cheenikai <i>Acacia concinna</i>	Fruits	Shikakai; Seeds used as natural soap or hair shampoo
3	Kudumpuzhi <i>Garcinia gummigutta</i>	Fruits	Fruit rind used as condiment; Seeds yield fat-rich butter
4	Thippalli <i>Piper longum</i>	Fruits	Spice useful in indigestion, asthma, cough etc. but it is also aphrodisiac and antiaging spice
5	Naruneendi <i>Hemidesmus indicus</i>	Roots	Used in the treatment of oligospermia, gastritis, anorexia, menorrhagia etc.
6	Karumkurinji <i>Nilgiranthus ciliates</i>	Roots	Roots are used against neurological disorders, sciatica, glandular swellings and oedema
7	Kurumthotti <i>Sida rhombifolia</i>	Roots	Treatment of rheumatic diseases, Vata disorders like knee pain, joint pains etc.
8	Nagadhanthi <i>Baliospermum montanum</i>	Roots	Acts as purgative; induces diarrhoea; useful in treating liver disorders, digestive disorders, haemorrhoids etc.
9	Sathavari <i>Asparagus racemosus</i>	Roots	Treatment of stomach upset, constipation, stomach ulcers, fluid retention, pain, anxiety, cancer, diarrhoea, bronchitis, tuberculosis, dementia, diabetes, and uterine bleeding; also as an aphrodisiac
10	Incha <i>Acacia pennata</i>	Bark	Bark is used for treatment of bronchitis, asthma and stomach complaints
11	Moovila <i>Psuedarthria viscida</i>	Whole plant	Treatment of asthma and nervous dysfunction, insect bites, inflammations, vomiting, etc.
12	Amolpuri <i>Rauwolfia serpentine</i>	Roots	Root as powder used to treat mental diseases, poisoning and visuchika
13	Oorila <i>Desmodium gangeticum</i>	Whole plant	Carminative, rejuvenative, aphrodisiac; used in fevers, oedema, kidney disorders and post-delivery complications; Roots have febrifuge, expectorant, diuretic properties. It is anti-dysenteric, anti-diarrhoea and galactagogue.
14	Mulayari <i>Bambusa bamboo</i>	Seeds	Beneficial in joint pain, back pain and rheumatic pain as well. For those suffering from cholesterol issues, regular consumption of bamboo rice helps lower cholesterol levels. Also, it has anti-diabetic properties

Publication: Jagannatha Rao R. and Arthur Mark Selwyn. 2021. Development and standardisation of semi-processing technology to enhance the quality and market value of selected medicinal plants in Peechi Wildlife Sanctuary and Silent Valley National Park, Kerala. Pp 1-176

Project 13 Revitalization of MPCA and MPDA program- Review of the progress and conservation status of MPCAs and Guidelines for strengthening the Program

Relevance: MPCAs (Medicinal Plants Conservation Area) are an important and efficient model for insitu conservation of wild medicinal plants in India. These are generally small forest patches (average of 200 ha) identified in select forest areas that capture natural populations of threatened medicinal plants. MPCAs are also known to represent a high proportion (~50%) of a state's overall medicinal plants diversity. During 1993–2015 such MPCAs were established at 210 sites in 21 States of India, which are currently in different stages of succession. The understanding among resource managers about the significance of MPCAs (in respect of diversity, distribution and population status of medicinal plants, prevailing threats, and overall status) is not sufficient to enable them devise suitable conservation strategies. The present project is a step towards strengthening their understanding by making a comprehensive review of the current conservation status of MPCAs.

Highlights of Project progress/ Achievements:

a) Preparation of priority lists of medicinal plants:

The team thoroughly reviewed the list of traded medicinal plants in India (from NMPB's demand and supply of medicinal plants) and short listed the species in high-volume trade (endemic, red listed), which are found in the MPCAs. This list was to be used as primary basis for selection of MPCAs for review.

b) Selection of MPCAs for review:

The list of priority species was subsequently used as the baseline for choosing MPCAs for review. This list was to be superimposed on the overall inventories of medicinal plants in the MPCAs, and those MPCAs which recorded higher presence of priority species were to be chosen for the review. During the current year MPCAs of Karnataka, Kerala, Tamil Nadu, Maharashtra, Andhra Pradesh (undivided) and West Bengal were focused for the review. Necessary data from the previous field studies in these MPCAs carried out by in house teams were gathered and analyzed. Based on the presence of priority species, the MPCAs in these states were shortlisted for review and ground truthing studies.

c) Design of Review methodology:

The team during the year developed a draft protocol for the review based on conservation assessment tools currently in use by IUCN and WWF. Additionally, different taxonomic/ vegetation parameters such as presence of red listed/ endemic and HVT medicinal plant species, overall plant diversity, intensity of threats, forest type, extent of area, are included. The draft protocol will be field tested in select MPCA sites during the next year, for its suitability for the current review.

Project 14 Facilitating BMCs in Education, Awareness and Skill Development and Preparation of People's Biodiversity Registers (PBRs) in Haryana State

Relevance: As per the section 41 (1) of the Biological Diversity Act, 2002, every local administrative body (Panchayat, Municipality, Municipal Corporation etc) is expected to constitute a BMC (Biodiversity Management Committees) within the jurisdiction for the purpose of promoting conservation, sustainable use of bio-resources, preservation of habitats, conservation of land races, cultivars, breeds of domestic animals associated with traditional knowledge. The main function of a BMC is to prepare People's Biodiversity Register (PBR) in consultation with the local people. This register is expected to serve as an authentic comprehensive documentation of local biodiversity elements and their traditional knowledge found in a village (flora, fauna, their uses, landscapes, soil types, both under domestic and wild conditions).

In this context, Haryana State Biodiversity Board, has engaged TDU as a Technical Support Group, for taking up awareness and capacity building of local BMCs and preparation of PBRs in the 3 districts of Haryana.

Highlights of Project progress/ Achievements:

The project began in December 2020 in Nuh, Palwal and Rohtak districts of Haryana. To cover the geographical expanse of these three districts, field teams were constituted with volunteers having necessary subject background in Science. After an initial orientation training for 1 week, these volunteers were deployed in different villages for field documentation of PBRs. The task began simultaneously in all the GPs in association with the BMCs. The First drafts of PBRs were further strengthened with appropriate support information related to land use, socio-economic profile, details of educational institutions from Census reports and District Gazetteers. The first drafts were submitted for interim reviews by the local district departments of Forestry, Rural Development, Agriculture, Animal Husbandry and Horticulture. Additionally, regular field reviews by PBR quality monitoring committees, constituted by HSBB, were also conducted. Based on the suggestions by the review teams, the PBRs were put for vetting by subject experts.

During the current year, first drafts of PBRs were completed in all the BMCs, and subsequently, revisiting of BMCs for further data updation and BMC training was initiated in all the BMCs of all three districts. The final second drafts of all the BMCs in the three districts will be submitted to HSBB, during the next year.

Project 15 One-week Refresher training course for the officers of Indian Forest Service (IFS)

Relevance: Indira Gandhi National Forest Academy (IGNFA), Dehradun is the apex body in the country for Forestry education in the country. One of the major objects of IGNFA is to train the officers from Indian Forest Service and officers from the state forest departments to build their technical and management capacities. IGNFA in this direction organizes various training programs/ courses. TDU being the knowledge partner on Conservation of Medicinal plants in the country was entrusted the task of providing training to officers from Indian Forest Service. During the current year, MOEF& CC, Govt of India sanctioned 1-week refresher course for IFS officers on the theme, "Sustainable development of medicinal plants in India-lessons from India and beyond".

Highlights of Project progress/ Achievements:

The Training course was organized during 21-25 March, 2022 at Bengaluru. Thirty-five senior forest officers from different states were nominated for the course. Of the thirty-five, 17 officers confirmed their participation and finally, 8 officers took part in the program.

The program was structured around the major themes:

- a) Appreciation for conservational profile of medicinal plants,
- b) Significance of MPCAs- methodology of establishment, future directions for advancing insitu conservation of medicinal plants
- c) Traditional knowledge associated with medicinal plants and its applications
- d) 21st century developments in medicinal plants-bridging Science and traditional knowledge

Shri Sudarshan, CEO, Karnataka Medicinal Plants Authority, Bengaluru inaugurated the course.

The learning sessions were structured with multi-media presentations, field visits, lab visits, interactions with faculty/scientists and group discussions. The officers were taken to the Toyota Eco zone, the land restoration site of Toyota Kirloskar Motors, at Bidadi, Bengaluru, which illustrated the innovative ways of restoration of a degraded land site, using wild medicinal plants.

All the learning sessions witnessed an overwhelming participation by the officers, because of the novelty in the approach and the subject contents. The participants' evaluation score of the course was 9.0 out of 10.0, which indicates the higher acceptance level of the subjects covered in the program.

Seminars and Workshops

Somashekhar B S participated in the following Workshops as invited Resource person and presented the papers.

1. **"Impact of Climate Change on Mangroves in Karnataka"**. Expert meeting on Mangrove ecosystems. 11-12, November 2022, Kasarakod. IFHD and Snehakunja.
2. **"Science Education in Higher Secondary Schools in Karnataka: coverage of environmental science in School text books- an overview"**. National Seminar on Science and Science Education, 9-11 December 2022, Gulbarga. Azim Premji University and Central University Karnataka, Gulbarga.

Publications/ Reserach articles:

Somashekhar B S regularly wrote a Science column on Wild Fruits of Karnataka in Kuthoohali, the Science monthly in Kannada, published by Vigyan Prasar, New Delhi and Karnataka Science and Technology Academy, Bengaluru. Seven write ups were published during the current year, while each write up focused on a select wild fruit species from Karnataka and included: Bilimbi, Yellow Plum, Bullock's Heart, Citron, Gardenia gummifera, Karonda and Bakula.

Radio Talks

Somashekhar B S delivered the following 5 Radio Science talks in Kannada during the current year:

1. Restoration of Landscapes and Conservation of Grasslands, on World Environment day, 5 June 2021, All India Radio, Bangalore. The talk went on air simultaneously from all the Radio stations in Karnataka.
2. Four short science talks under the theme "Everyday Science for Everyone" were broadcasted during September-October 2021 from All India Radio, Bangalore. The talks went on air simultaneously from all the Radio stations in Karnataka. Following are the titles of the talks:
 - a) Erratic Blossom Showers- signs of Climate change.
 - b) Local extinction of endemic species- warning signal of Climate Change
 - c) Why tender leaves in Tropical plants are red?
 - d) Lignin in Plant fibers and its degradation in soil

4. Centre for Ethno-Veterinary Science and Practice

Sl. No.	Title of research/outreach/ education projects implemented in 2021-22	Source of funding	Team members associated with each project
1	“Training and Empowering in Ethno-veterinary Practices and Veterinary Ayurveda for reduction of antibiotics and other veterinary drugs for supply chain dairy industries of Abbott”(Online)	ABBOTT	Dr. Kumar SK, Dr. Punniamurthy Dr M N Balakrishnan Nair Dr. Satheeshkumar
2	“Management of antibiotic resistance pathogens in clinical mastitis by Ethno veterinary (Ayurveda) formulations”	Gokul dairy	Dr. Kumar S K

“Training and Empowering in Ethno-veterinary Practices and Veterinary Ayurveda for reduction of antibiotics and other veterinary drugs for supply chain dairy industries of Abbott” (Online)

Relevance : This project presented to Abbott aims to improve animal health, farmer income and milk quality in smallholder dairy farmers organized by Abbott Nutrition through popularizing the use of ethno-veterinary practices and Veterinary Ayurveda.

Objective

- To train and empower the stake holders to reduce the uses of Antibiotics in dairy farming by using Ethno-veterinary and Veterinary Ayurveda to achieve the quality standards of milk (Antibiotic residue free).
- Highlights of progress/ achievements of projects/programs: 200 words report only noteworthy/ striking elements of findings/ outputs, as bullets/ short phrases (not more than 200 words)

We started online training for four supply chain dairy industries of ABBOTT nutrition from October, 2020. The structure of the training was divided into two training per one quarter i.e one training at the beginning of the each quarter and refresher training at the end the each quarter.

This year we conducted training of last two quarter of the project. In which 28 veterinarians and field officers of four supply chain dairy industries of ABBOTT nutrition were trained to manage clinical conditions like Wounds , Maggot wounds, Uterine infections, Retention of placenta, Uterine prolapse, Downer cow, Dermatitis, HCN Poisoning , Teat obstruction, Anorexia , Ethno pharmacology, Post partum complications etc. In one year training they learned manage about 25 clinical conditions of the cattle using EVP. They were also given morphological characteristic of 36 medicinal plants for their identification in the field including the Ayurveda description and properties. All the 4 supply chain dairy companies demonstrated one recipe each during the training program. The trained veterinarians are using EVP for managing certain health conditions of the cattle and reduce the use of antibiotics for management of animal health. This in turn reduces the residue in the milk and related AMR.

“Management of antibiotic resistance pathogens in clinical mastitis by Ethno veterinary (Ayurveda) formulations”

Relevance : The aim of this work was to detect antibiotic resistance pathogens isolated from milk samples in clinical mastitis in cattle and its management by ethnoveterinary formulations.

Objectives

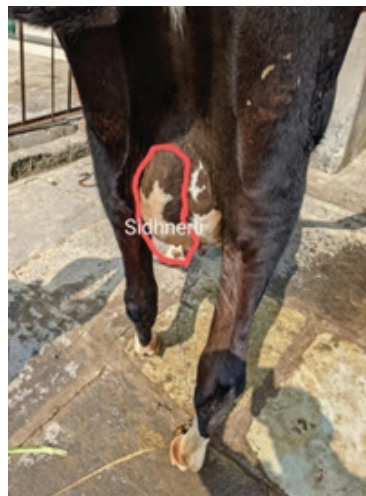
1. Screening of animals for clinical mastitis collecting milk samples.
2. Identification of antibacterial resistance pathogens in clinical mastitis.
3. Intervening with Ethnoveterinary formulation for antibacterial resistance pathogen in clinical Mastitis for 10 days and measuring the outcomes of the interventions.
4. Identifying the antimicrobial residues in the milk samples.

Highlights of progress/ achievements of projects/programs:

This project started from January, 2021. By the end of March 2022, Total 29 cases of clinical mastitis which are resistant to antibiotics were recruited for the study. Out of 29 cases 16 cases got completely cured, 4 cases partially cured and 9 cases not cured clinically. Out of 29 cases of resistant to antibiotics after 12 days of intervention, 24 animals become sensitive to antibiotics, 2 animals resistance continues and 3 animals does not found bacteria in the milk. Total 17 antibiotics were in use in field, out of 17 antibiotics 15 antibiotics become sensitive after the interventions. As project started from Jan 2021 until Dec 2021 the cases data analyzed by statistician to know the outcomes of the research.

Antibiotics resistant and sensitive-frequency distribution of animals studied (Jan 2021-Dec 2021)

Sl. No.	ANTIBIOTICS	Resistant(n=21)		SENSITIVE(n=21)	
		No	%	No	%
1	Amikacin	16	76.2	5	23.8
2	Amoxirum	12	57.1	2	9.5
3	Amoxyclav	15	71.4	1	4.8
4	Ciprofloxacin	20	95.2	9	42.9
5	Ceftriaxone	16	76.2	5	23.8
6	Ceftizoxime	8	38.1	3	14.3
7	Ceftotaxine	5	23.8	1	4.8
8	Cefoperazone	9	42.9	1	4.8
9	Enrofloxacin	17	81.0	7	33.3
10	Gentamicin	7	33.3	1	4.8
11	Levofloxacin	20	95.2	8	38.1
12	Neomycin/ Unimicin	2	9.5	2	9.5
13	Oxytetracycline	17	81.0	6	28.6
14	Sulphatrim	4	19.0	1	4.8
15	Tazo	10	47.6	4	19.0
16	Tylosine	9	42.9	0	0.0
17	Cotrimoxazole	7	33.3	0	0.0



Animals recruited for the project from various villages of Gokul dairy.



Steering committee meeting at Gokul dairy

Publications

1. Dutta, P. Harikumar AV, Shroff SI, Rana SK, Mogale UV, Magare V, Punniamurthy N, Nair MNB and Gorhe SB 2022. Management of repeat breeding in bovine by herbal combination. *Journal of Entomology and Zoology Studies* 2022; 10(1): 295-297
2. Dutta, P. AV Hari Kumar, AC Mahajan, S Shroff, SK Rana, PJ Sahariah, P Gogoi, D Borah, N Punniamurthy and MNB Nair 2022. Case reports on management of LSD like conditions with ethno-veterinary practices. *The Pharma Innovation Journal* 2022; SP-11(1): 236-239
3. Katrienvan'tHooft, GetachewGebbru, M.N.B.Nair, N. Punniamurthy, E. Katushabe and Maria Groot 2021. New strategy to reduce antibiotics in dairy farming. *Gateway to the global dairy industry*.
<https://www.dairyglobal.net/specials/new-strategy-to-reduce-antibiotics-in-dairy-farming/>
4. Nair M N B, Punniamurthy, N., Kumar, S. K., Shankar Darshan, 2021. Ethno-veterinary herbal formulations: An indigenous strategy to reduce use of antibiotics in the management of livestock health. *Indian J. Comp. Microbiol. Immunol. Infect. Dis. Technical Article Vol. 42 (Special Issue) November, 2021: 76-82.*
5. S.K. Rana^{1*}, A.V. Harikumar¹, P. Dutta¹, S. Shroff¹, S.K. Dash¹, N. Punniamurthy¹, M.N.B. Nair. 2021. Use of ethno-veterinary medicine for management of common ailments of dairy animals *Indian J. Comp. Microbiol. Immunol. Infect. Dis. Technical Article Vol. 42 (Special Issue) November, 2021: 83-87*
6. Ngwisha J, Samutela M, Phiri B, Zulu M, Mwasinga W, Balakrishnan N, Choongo K, Hang'ombe B. In-vitro potential of crude extracts of selected garden herbs for mastitis management in Zambia. *University of Zambia Journal of Agricultural and Biomedical Sciences [Internet]*. 5Jul.2021 [cited 10Nov.2021];5(1). Available from: <https://journals.unza.zm/index.php/JABS/article/view/523>
7. Prathap Kumar Kothapalli* ,M.N. Balakrishna Nair, N. Punniyamurthy 2021. Mycotoxin induced antibiotic resistance, an unsuspected public health impact: a perspective review *Ind. J. Vet. & Anim. Sci. Res.*, 50 (4) 1-15, July - August, 2021

8. Santhosha Hegde¹, Pavithra Narendran¹, MalaliGowda andM N Balakrishnan Nair. 2021. Metagenomic Profiling of Bovine Milk from Mastitis Infected Udder of the Cows before and after Treatment with Ethno-Veterinary Practice (EVP)". EC Veterinary Science 6.7.
9. MN Balakrishnan Nair and Punniamurthy N. 2021 "Ethno-Veterinary Practices (EVP) as a New Approach for Management of Cattle Health without Antimicrobial and Other Chemical Veterinary Drugs". EC Veterinary Science 6.5.

Chapter in the books

1. Balakrishnan Nair, N. Punniamurthy, S. K. Kumar 2021. Ethno-veterinary Practices for Animal Health Management and the Associated Medicinal Plants from 24 Locations in 10 Indian StatesCurrent Research in Agriculture and Veterinary Sciences Vol. 3, 2 June 2021 , Page 86-102 <https://doi.org/10.9734/bpi/cravs/v3/1691C>Published: 2021-06-02
2. S. K. Kumar, P. M. Deepa and N. Punnimurthy, Study on the Prevention of Mastitis in Cattle during Dry Period Using Herbal Formulation, Chapter 1 , Research Aspects in Agriculture and Veterinary Science Vol. 4 DOI: 10.9734/bpi/raavs/v4/13490D Print ISBN: 978-93-5547-226-7, eBook ISBN: 978-93-5547-234-2

Academic programs implemented by the center

Faculty involved

Sl No	Name of faculty	Topic taught
1.	Emeritus professor Punniamurthy	Trained to manage 25 clinical conditions of the cattle using EVP
2.	Emeritus professor M N Balakrishnan Nair	Morphological characteristic and properties of 37 medicinal plants for their identification in the field and their use
3.	Assistant Professor Kumar S K	<ul style="list-style-type: none"> • Basics principles of Ayurveda for MSc Ayurveda Biology students. • Basics of Ayurveda Pharmacology and Pharmaceutics. • The Ayurveda description and properties of 37 medicinal plants used in Ethnoveterinary formulations to manage 25 clinical conditions of dairy animals and human clinical uses.

5. Centre for Functional Genomics and Bio-informatics

Sl. No.	Title of research/outreach/ education projects implemented in 2021-22	Source of funding	Team members associated with each project
1	Explore the correlation between HLA and Prakriti types in context with Cases of Bone Marrow Transplantation	Kiran Mazumdar Shaw Grant	PI: Dr. Pavithra N Co-PI: Dr. Poornima Devkumar and Dr. Prasan Shankar Hon. Advisor: Prof. Malali Gowda JRF- Ms. Namitha R, Ms. Manasa K H
2	Well-structured genomic resource database with searchable portal for mining gene, proteins, biomolecules and functional pathways for 50 high volume traded medicinal plants of India	Kiran Mazumdar Shaw Grant	Dr. Prasanna S koti Mr. Santhosha N Hegde
3	Elucidation of molecular mechanisms involved in Pistacia-aphid gall development	Dabur	Pavithra Narendran, Mr. Santhosha N Hegde, Dr. Noorunnisa Begum, Dr. Malali Gowda, Dr. SubrahmanyaKumar and Dr. Padma Venkatasubramanian

Explore the correlation between HLA and Prakriti types in context with Cases of Bone Marrow Transplantation

Prakriti is like the genome of an individual which is constant and determined at the time of conception and remains the same throughout life (Amin H and Sharma R, 2016). Human Leukocyte Antigen (HLA), class I (HLA-A, Band C) and class II (HLA-DR, DQ and DP) genes that are the most important in the human genome responsible for the regulation of the human immune system. We hypothesize that correlation between HLA alleles and Prakriti types will be of high predictive nature in finding matches for organ transplant in similar Prakriti types. From the study, 300 subjects (donor-150, recipient-150) who have undergone and undergoing Bone Marrow transplant will be recruited. To these subjects, Prakriti analysis will be performed and HLA data will be collected for correlation study.

Highlights of progress/ achievements of projects/programs:

- Recruitment of 97 subjects from Mazumdar Medical Centre was carried out. Prakriti analysis has been carried out for 74 subjects (37 recipients and 37 donors) directly in person and through electronic means (WhatsApp video call / normal calls).
- HLA data was also obtained from Mazumdar Medical Centre for the same subjects.
- 45.97 % analysed donor-recipient pair have apparent similarity between the Prakriti of donor and recipient w.r.t one or more doshik type scores

- The control study was carried out for 7 families, (28 subjects). To see the correlation of the Prakriti among the siblings and family members
- From our study, we About 40.54% of the recruited participants (bone marrow recipients n=37) were diagnosed with Acute Myeloid Leukemia (AML). Among the 37 recipients (i.e., patients diagnosed with different types of blood cancers in this study), 51.35% belong to the 'O' positive blood group and about 32.43% of the recruited participants (bone marrow recipients n=37) were found to be HLA*A- 02, HLA*A- 01 (24.32%), HLA *B-35(35.14%), HLA *C-04 (35.14%), HLA* DRB1-04(13.51), HLA*DQB1*03 (18.92%) HLA DRB1*13 was found in Kapha type.

Well-structured genomic resource database with searchable portal for mining gene, proteins, biomolecules and functional pathways for 50 high volume traded medicinal plants of India

Over the last two years, with the help of funds from the Kiran Mazumdar Shaw Foundation, we've been able to build a functional genomics resource database of already sequenced medicinal plants used in Indian traditional medicine systems. At present, it forms a repository of about 50 medicinal plants genomic data and allied information, the resource also hosts sequence similarity comparison tool and genome browser as a standard inclusion. We have also initiated to build a tool which can catalogue five effective compounds of each plant and its protein interactors in the human genome.

Highlights of progress/ achievements of projects/programs:

- Collection of phytomolecules and its pathway specific information.
- Collection of information regarding the roles of genes/ enzymes in the pathways.
- Construction of the landing page of the web resource and currently it has been named TDU
- MPGRD.
- Construction of the Sequence Server Blast page.
- Construction of the Genome Browser page.
- Construction of MySQL database, pathway and contact us page.

Elucidation of molecular mechanisms involved in Pistacia-aphid gall development

Pistacia chinensis subsp. *integerrima* (J. L. Stewart ex Brandis) Rech. f. belongs to the family Anacardiaceae and is a dioecious tree native to Asia widely distributed in East Afghanistan, Pakistan, North West & West Himalaya. This plant is well known for formation of galls on leaves and petioles. Studies have been reported that gall formation is species specific induced by insect parasitism and it is a mutualistic relationship. The galls of *Pistacia chinensis* subsp. *integerrima* are source of secondary metabolites which is used for the treatment of cough and respiratory ailments, loss of appetite, dyspeptic vomiting, and dysentery. Karkatashringi is one of the ingredients in many ayurvedic formulations such as shringiadi chura, karkatadi chura, balachaturbhadra churna, brihat talisadi churna, devadarvayadi kwatha churna, shatavaryadi ghrita, chayanprasha avaleha, dashmularista, siva gutika, khadiradi gutika etc. The estimated annual demand for Karkatashringi is about 150-200 MT in India alone. However, the molecular mechanisms involved in the induction

and development of gall is not known. The gall requirement is huge, but for some unknown reasons their formation has been reduced dramatically. In this study, we aimed to understand the molecular mechanisms of gall development (plant-insect) through the transcriptome and microbiome analysis of *Pistacia chinensis* subsp. *integerrima* galls using Next Generation Sequencing technology (NGS). In addition to this proteome and metabolite analysis was taken up to understand the gall structure composition. The molecular understanding of *Pistacia chinensis* subsp. *integerrima* will help us to conserve the galls for future purpose and identify the genes responsible for gall formation.

Highlights of progress/ achievements of projects/programs:

Elucidation of molecular mechanisms involved in *Pistacia*-aphid gall development

- In our study we observed that there are no genes from auxin biosynthesis in gall which suggests that these auxin biosynthesis genes may be exogenous, and supplied by the gall forming organisms within the gall. In addition we identified, some of the genes involved in the plant-aphid interaction have been upregulated.
- The genes related to phytohormone signal transduction were highly expressed in gall than leaf
- We identified genus *Aeromonas* as the most abundant genus in gall. In the case of leaves, *Enterobacteriaceae* is the most abundant bacterial family in the leaf. Also, we identified *Glomerallaceae* family fungus is more abundant in gall and *Lambertella* genus is more abundant in leaf sample
- Many novel metabolites were identified in *Pistacia integerrima* gall and leaf. Various metabolite categories with putative therapeutic benefits were identified.
- The top enriched pathways in gall are linoleic acid metabolism, taurine and hypotaurine metabolism, sesquiterpenoid and triterpenoid biosynthesis, Sphingolipid metabolism etc whereas in leaf, taurine and hypotaurine metabolism, linoleic acid metabolism, indole alkaloid biosynthesis, sulfur metabolism, etc are enriched.

Academic programs implemented by the center

Sl. No.	Name of Program 2020-21	No of students	Final output	Program Specifics / Goals of program	Funding (if any)	Program Co-ordinator	Faculty involved
1.	Metagenomics approach Microbiome data analysis	31	E-Signed Certificate	To educate the minds with the latest NGS technologies and data analysis which gives deep insight into the genomics world. An interdisciplinary view on Microbiome Data using Bioinformatics tools with a Metagenomics approach.	Participants Registration Fees	Dr. Pavithra N and Dr. Lavanya D. K	Dr. Pavithra N, Dr. Lavanya D. K, Dr. Prasanna S Koti, Mr. Santhosh Hegde, Ms. Manasa K H and Ms. Namitha R
2.	In- silico Drug Discovery	9	E-Signed Certificate	In-silico drug design provides an important lead for the development of new drugs for several diseases. In this training program, we aim to train the participants on usage of computational tools to design the suitable drug for random evolutions of synthetic and natural product for the targeted molecules and modelling techniques for three dimensional structure based drug design. This training program will be exciting to participants as they will travel through drug discovery world.	Participants Registration Fees	Dr. Pavithra N and Dr. Lavanya D. K	Dr. Pavithra N

M.Sc. in Biological Sciences by Research (Functional Genomics and Bioinformatics)

1. Ms. Annapoorna Shivanand:

- Project titled ' Know your Pedigree : A family based webtool tool to trace genetic inheritance of traits.' entailed building a web tool specifically for Mendelian rare diseases to help trace it in families through pedigrees.
- The project began in November 2019 and successfully the thesis submission was concluded in March 2021.

2. Ms. Mahalakshmi P:

- Project titled ' Whole genome data analysis of Saraca asoca'
- Course began in Dec 2020. 1st semester exams were held in June 2021 and 2nd semester exams were held in April 2022.
- 1st and 2nd semester successfully completed.

Name of the Programme - Internship

The progress of science is punctuated by the advent of revolutionary technologies that provide new ways and scales to formulate scientific questions and advance knowledge. So the Center for Functional Genomics and Bioinformatics offered a complete hands-on internship programme for the duration of 1-6 months. The internship offered is to enhance the knowledge of Students, Faculty and Scientists from Academia, Industries including Life Sciences, Biology, Computer, Medicine, Agriculture, Veterinary, Environmental Science and any other disciplines in the field of Genomics and Bioinformatics.

Name of Program	Audience	Program Specifics	Team members
Internship	23	<ul style="list-style-type: none">• Thirteen students for one-month skilled internship• Two students for 6 months project-based internship• Eight students are enrolled for short term (2 months) internship	Dr. Pavithra N Mr. Santhosh Hegde Ms. Manasa K H Ms. Namitha R

Key outcome of all the training Programs: -

Skill enhancement

Independently perform data analysis

Exposure to NGS techniques

6. Centre for Local Health Traditions and Policy

Sl. No.	Title of research/ outreach/ education projects implemented in 2021-22	Source of funding	Team members associated with each project
1	BOSCH – TDU Program on Integrative Health Sciences	BOSCH-India Foundation-CSR, Bengaluru	Dr. Prakash BN, Dr. Gurmeet Singh, Dr. Subrahmanya Kumar, Dr. Poornima Devkumar, Dr. Megha, Mr. Varun Subramanyam, Dr. Sreejesh, Dr. Bhargavi, Dr. Abhilash, Dr. Arpita, Dr. Poorvi, Dr. Soundarya RJ, Ms. Sushila, Ms. Asha, Ms. Shobha, Ms. Sudha, Mr. Prakash, Ms. Bhavya, Dr. Neelambika GB, Dr. Prasan Shankar, Dr. Prashanth R, Dr. Rashel M Rego, Dr. Sahana, Dr. Shreelatha, Dr. Vikram Balu, Dr. Yashawini, Mr. Ashwin Perumal, Ms. Avineet Luthra, Mr. Raghavendra
2	Voluntary Certification Scheme for Traditional Community Healthcare Providers (VCSTCHP)	Department of Adi Dravidar and Tribal Welfare, Government of Tamil Nadu, Friends of Hope, United Kingdom, Biomerieux CSR and self-funded	Prof. Hariramamurthi G., Dr. Prakash B N, Dr. Poorvi Priscilla A, Dr. Arun Bhanu, Empaneled evaluators and TCHP Advisory Board members of Karnataka, Kerala, Andhra Pradesh and Tamil Nadu
3	Study of the knowledge, attitude and practices of health care traditions pertaining to iron deficiency anaemia among the local communities of Nilgiris district, Tamil Nadu	RIST	Dr. Prakash BN, Dr. Poorvi Priscilla A, Mr. K. Balasubramaniam, Ms. Rajalakshmi, Ms. B. Kaaliammal, Ms. N. Vijaya, Ms. R. Kaliammal, Ms. R. Parvathy, Ms. S. Lakshmi, Ms. S.Rajeshwari, Ms. S. Saroja, Ms. S.Sathyakala, Ms. S.Vasanthi, Ms. T. Kavitha

Project title: BOSCH - TDU Project on Integrative Health Sciences

Relevance of the Project:

This pilot project aimed to execute a wellness and respiratory health program developed & designed by TDU-IAIM on the Ayurveda Swasthya framework and collect multi-dimensional health datasets to evaluate the efficacy of the program in meeting its objectives of improving respiratory health & general wellness (Fig 1). The name of this project, “Nanna Usiru, Nanna Swasthya” (Kannada) or “My breath, my health” implemented in Five villages in Bidadi, Ramanagara district, Karnataka, India.

Highlights of progress/ achievements of project:

i) Community Participation

- a) High compliance to the program: Of 278 participants recruited, 265 participants complied with interventions that covered the spectrum of activities from product usage to yoga.
- b) Enhanced health status: Up to 67% of participants reported an improvement in overall health, which was corroborated by objective clinical assessment tools such as quality of life, wellness score, respiratory health and blood biochemistry.
- c) Family empowerment: > 65% of participants reported increased awareness about importance and methods of managing their own health. A testimony of a villager is added as Fig 2.

ii) Competencies Created

- a) Developed local leadership: Local residents were chosen as health workers and trained in technology as well as healthcare practices.
- b) Developed a community-responsive clinical team
- c) Developed, implemented and validated personalised health assessment tools
- d) Designed and optimised acceptance of dinacharya (daily regimen) practices

iii) Digital Tools

- a) Created a ‘tech’ and ‘touch’ approach for the implementation of the project. Salesforce platform & KoboCollect tools form the technology component, whereas five health workers at the villages and five health coaches played the role of touch to effectively implement the key interventions of the project.
- b) Real Time monitoring of field, clinical activities using Sales force platform and teleconsultation
- c) Adaptation of telemedicine for community health monitoring

List of publications during 2021-22

Report on pilot program towards building an innovative 4th non-institution, community driven tier in the National Health System, BOSCH-TDU project, 2021-22.

Program title: Voluntary Certification Scheme for Traditional Community Healthcare Providers (VCSTCHP)

Relevance of the Program:

VCSTCHP is a National Personnel Certification Scheme, jointly launched by Quality Council of India (QCI), New Delhi and Foundation for Revitalisation of Local Health Traditions (FRLHT), Bengaluru. TDU is a Personnel Certification Body (PrCB) approved by QCI, to assess and certify community based, traditional healers through a process of evaluation of their prior knowledge and skills in specific streams (health conditions), based on the Minimum Standards of Competence (MSC) as per ISO 17024.

Highlights of program:

- Prior knowledge and skills of 24 traditional healers from Kerala 15th & 16th December 2021 were assessed at Kozhikode based on MSC through multiple choice questions, case presentation and viva-voce. As a part of practical demonstration, the candidates identified the medicinal plants and prepared the herbal formulations for selected health conditions. The evaluation was conducted for four streams namely - Common ailments, Jaundice, Traditional Bone Setting and Arthritis. Field verification was under taken from 17th to 19th December 2021 and 9th and 10th January 2022, to verify the work environment, community feedback, facility for preparation of medicine, presence of herbal garden and hygiene (Fig. 3 & 4).
- 17 traditional healers applied for certification from Andhra Pradesh. The oral evaluation was conducted at Tirupati and field verification was done by evaluators by visiting field sites from 8th to 11 December 2021 (Fig. 5).
- 120 traditional healers were certified from Nilgiris, funded by District Adi Dravidar and Tribal Welfare Officer, Government of Tamil Nadu, Ooty, Tamil Nadu. The oral assessment and field verification as done by the evaluation team from 8th to 15th February 2022 (Fig. 6 & 7).

Program title: Study of the knowledge, attitude and practices of health care traditions pertaining to iron deficiency anaemia among the local communities of Nilgiris district, Tamil Nadu

Relevance of the Program:

Iron Deficiency Anaemia (IDA) is becoming a global health problem. Local solutions are essential to address this issue. A study to understand perspectives of local communities towards Iron Deficiency Anaemia (IDA) through KAP survey and to educate the community on prevention and management of IDA was implemented in communities of Nilgiris.

Highlights of program

- Online/offline meetings with village health workers regarding the study methodology was conducted before the onset of the study August-September, 2021 (Fig 8).
- 500 households received Anaemia awareness education and Nutritional education (dietary modifications) from 10 trained village health workers (Fig 9).

- Iron-rich snack/methi papad, once daily was provided to 100 IDA patients.
- A baseline and end line blood haemoglobin assessment was done for 100 participants
- The KAP survey done at the baseline and end line, showed that the nutrition based health education is able to enhance the knowledge and use of locally available ingredients for management of Iron-deficiency anaemia among the tribal population. The findings of sub-group analysis revealed 1-2 g/dL improvement in Hb% in those who consumed iron-rich snack for a period of 3 months.

List of publications during 2021-22

- Report on project towards Study of the knowledge, attitude and practices of health care traditions pertaining to iron deficiency anaemia among the local communities of Nilgiris district, Tamil Nadu, RIST project, 2021-22.

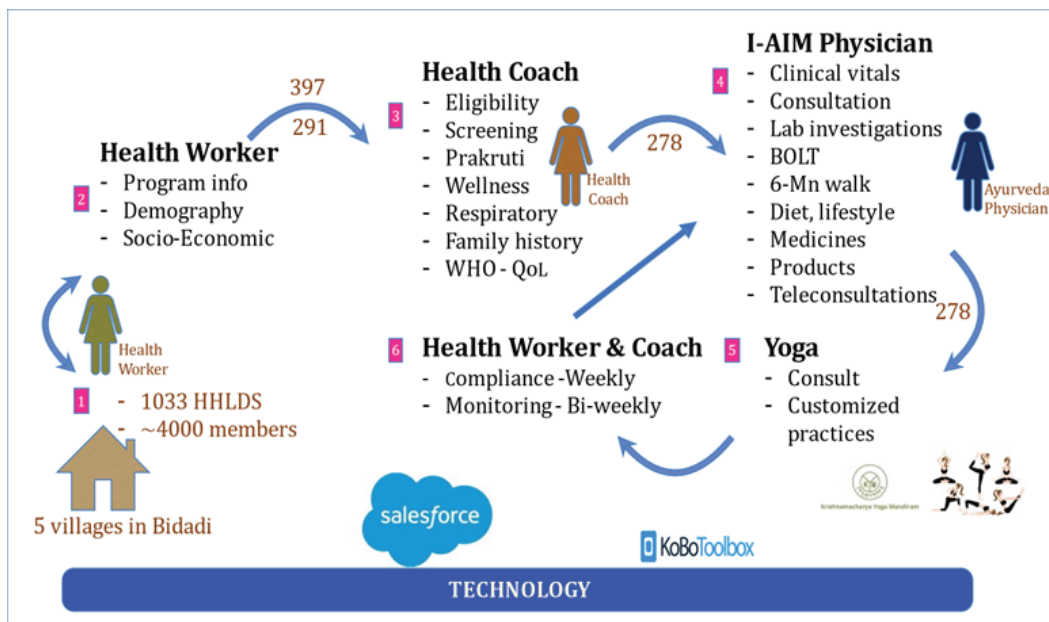


Fig. 1: The process followed in the project to identify, recruit participants and continuous engage them during the entire program.

“I frequently suffered from fever. I have consulted many doctors and taken medicine but there was no cure. Even if I do little household work, like cleaning, I have to take rest. After participating in this program I visited the I-IAM hospital. They gave me tablets, kashaya, taila for massage, and now I am completely alright. Almost 60 to 70 members from my village visited the I-AIM hospital and we all benefited from this program. Hearty thanks to BOSCH company. I am using all three products, by using kavala taila, kapha <phlegm> in my mouth was cleansed... snoring while sleeping <is> reduced after using nasya taila. Fever, body pain, swelling in the arms were all reduced.”



Fig. 2: A villager’s testimony (Transcribed and edited from a video testimonial).



Fig. 3: Oral evaluation of traditional healer from Kerala by empaneled evaluators and representatives from PrCB-TDU



Fig. 4: Field verification of traditional healer from Kerala by empaneled evaluators and representatives from PrCB-TDU



Fig. 5: Field verification of traditional healer from Andhra Pradesh by empaneled evaluators and representatives from PrCB-TDU



Fig. 6: Oral evaluation of traditional healer from Nilgiris, Tamil Nadu by empaneled evaluators



Fig. 7: Field verification of traditional healer from Nilgiris, Tamil Nadu by empaneled evaluators and representatives from PrCB-TDU

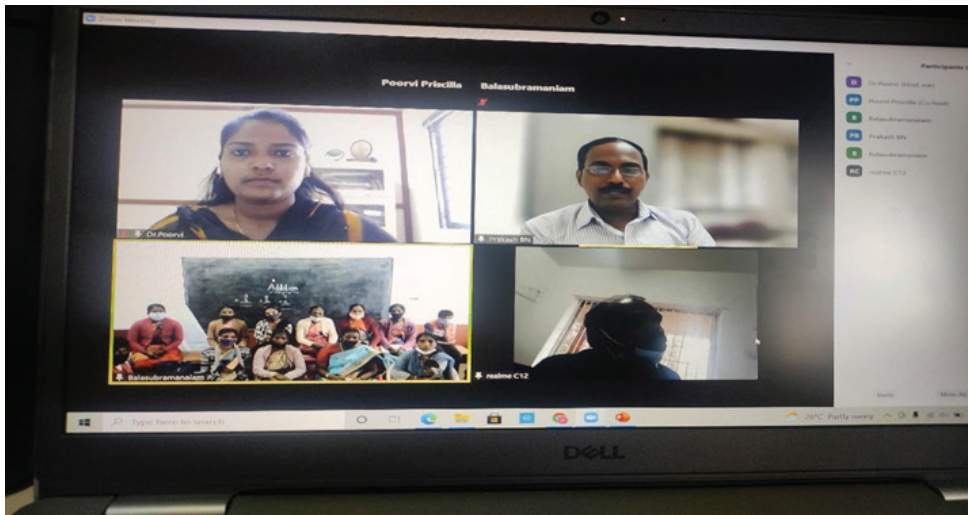


Fig. 8: Meeting with VHOs and Nawa Coordinators on 16th September 2021



Fig. 9: Flip chart to provide anaemia and nutrition education to all the VHOs



7. Centre for Traditional Knowledge, Data Science & Informatics

Sl. No.	Title of research/outreach/ education projects implemented in 2021-22	Source of funding	Team members associated with each project
1	Safe and effective use of herbal drugs in India: addressing the information needs of public health, research and commerce	KEW	Mr. Varun, Dr. Tabassum, Dr.Suma, Dr.Venugopalan Nair, Dr.Abdul Kareem,
2	MSc environmental science (Conservation practices)		Dr. Tabassum, Dr. Nirmalya Chatterjee, Mrs. Gowri Uday

Safe and effective use of herbal drugs in India: addressing the information needs of public health, research and commerce

Relevance of the Project:

India has extraordinarily rich living, evolving traditions which use over 6500 species of plants and plant based remedies derived from them. The Indian government has legally approved systems of healthcare in India like Ayurveda, Sowa Rigpa, Siddha and Unani based on the indigenous pharmacology of plants. An incredibly large number (~ 400,000) of plant based drug formulations for a wide range of simple and complex health conditions are documented in traditional literature. These have been computerised by the Indian Government's Traditional Knowledge Digital Library (Traditional Knowledge Digital Library). In the last two centuries, phytotherapies in Western medicine have borrowed from such traditional knowledge of plants and the traditional health sciences in India and continue to play a vital role within the Public Health system, both in the institutional health services, as well as home remedies.

Herbal Products such as those documented by TKDL continue to inspire the discovery of drugs and today, classical poly herbal formulations assessed on multi-omic platforms are providing insights into frontier areas of drug research like precision medicine and syndrome management for conditions that are multi factored and hence require multiple targets. Traditional medicinal clinics like Chinese medicine and Ayurveda and yoga are now commonplace in the UK, US and Europe opening up commercial possibilities for the export of Indian manufactured plant-products as well as of plant materials. For a comparison, the global market for Traditional Chinese Medicines was \$US 4.6 billion in 2016. The Indian Government has a policy to promote adoption of traditional health services and products abroad.

Current Issues: The pharmaceutical, common and trade names that are employed to refer to these plants and the products derived from them, are inherently imprecise or ambiguous. Names are used inconsistently in different parts of India and across disciplines. Scientific nomenclature offers the necessary rigour but is widely misunderstood and misused by health, commercial and regulatory bodies the world over.

The current inconsistency and imprecision hampers communication and data sharing within commerce, regulation and research in India. It hampers the authentication of plant materials and quality control of medicinal products. It limits access to international scientific publications (a search of the US National Institute of Health’s Medical Publication Library using one scientific name retrieves only 15% of the articles relating to that plant), complicates access to vital safety and efficacy data from patient records and clinical trials and leads to ineffective regulation. Similar issues prevent India from adequately protecting the IP embedded within its traditional knowledge systems or from engaging effectively with regulatory frameworks established for markets in the US or EU.

We developed a Portal for the Traded Indian medicinal plants (<http://tradedmedicinalplants.org/>) with the correct scientific names as retrieved from the nomenclature databases of Kew, and presented relevant information from the Ayurveda Pharmacopoeia of India, local names from the TDU database and the trade names as published in the books of Ved & Goraya (2015)

Highlights of progress/ achievements of projects/programs

Conducted several workshops to understand the challenges faced by the manufacturers and the Govt. bodies, solicited feedback on the design and content of our Portal and developed a portal that will be launched on the July 10th of 2022. The portal is here - <http://tradedmedicinalplants.org/>

List of publications during 2021-22 (Peer reviewed Publications/ books / reports / manual / handbook etc.)

Nair, S.N.V., Fathima, T.I., Naveen, S. (2022). Sandalwood: Traditional Knowledge from Ayurveda. In: Gowda, M., Mahesh, H., Kole, C. (eds) The Sandalwood Genome. Compendium of Plant Genomes. Springer, Cham. https://doi.org/10.1007/978-3-030-93394-4_3

Academic programs implemented by the center

- i. **Title of degree/ diploma / certificate program:** MSc Environmental science (Conservation practice)
- ii. **No of students :** 23 students @ATREE &TDU
- iii. **Goals of program:** Understand basic concepts and practices of Remote Sensing and Geographic Information Systems (GIS) and advances in spatial and their utility in environmental contexts
- iv. **Feedback of students:** Students are quite interested in the course particularly in Remote Sensing and GIS paper, further students like to implement its application in human dominated areas in national parks where they could distinguish between plantations, agriculture, watersheds, Land use land cover changes, Urban planning, forest cover etc. Few of the students like to use the application further in climate change studies which includes Cloud cover, precipitation and other atmospheric processes mapping.
- v. **faculty involved**

SI no	Name of faculty	Topic taught
1	Dr. Nirmalya Chatterjee, Instructor & Coordinator - ATREE	Remote Sensing & GIS
2	Dr.Tabassum Ishrath Fathima, Instructor - TDU	
3	Gowri Uday, TA -ATREE	

8. Vocational Education Cell

Sl. No.	Title of research/outreach/ education projects implemented in 2021-22	Source of funding	Team members associated with each project
1	Launch of first batch of B.Voc. and PG Diploma programs in Healthcare at Nipani: i) B.Voc. (MLT); ii) B.Voc. (MIT); iii) PG Diploma (MLT) on 2nd October 2021. MLT: Medical Laboratory Technology MIT: Medical Imaging Technology	Philanthropy loan, student fee payments	Partner: Learnerbay Education Pvt. Ltd. Team: Leena Wadia, Chetan H.C., Ranjith G., Suraj B.
2	Launch of second batch of students for the same three courses, also in Nipani, in March 2022	Same as above	Same as above

Relevance of Project:

In keeping with its vision and mission TDU has been conducting several vocational education programmes in both traditional and modern medical practices. The Vocational Education Cell (VEC) was established in March 2021 to launch programs leading to the Bachelor of Vocation (B.Voc.) and Post-Graduate Diploma degrees, inspired by Gandhiji's Nai-Talim.

Highlights of progress/ achievements of projects/ programs:

- The Bachelor of Vocation (B.Voc.) and PG Diploma programs launched by TDU are unique in that they are delivered in a partnership model with industry.
- TDU's first partner is 'Learnerbay Education Pvt. Ltd', an entity that has created the content for several programs in the Healthcare sector.
- A total of 225 students were enrolled across the three programs in October 2021, and a further 76 students in March 2022. After accounting for dropouts there are approximately 255 students in the system at the end of the first year.
- Learnerbay places the students into On-Job-Training (OJT) opportunities with hospitals, diagnostic centres, etc., as appropriate, from the very first semester and conducts theory classes for the students at their premises in Nipani. Most students start getting paid apprenticeships from the second or third year.
- The programs are based on work-integrated training and are fully apprenticeship/ internship enabled. This empowers students with the 'Earn-while-you-learn' feature that makes the program affordable.
- The program is rigorous. Students having to maintain careful records of their learnings at the workplace that are evaluated by their designated supervisor. The University conducts examinations and certifies the candidates. Students qualify for a Diploma after the first year and an Advanced Diploma after the second year.

Report on Academic programs implemented by the center

October 2021: Admissions

1. Title of degree - B. Voc Medical Laboratory Technology (MLT)

Total students enrolled – 131

Total students at 2nd semester - 114

Table on faculty involved (2nd Semester)

Sl no	Name of faculty	Topic taught
1	Ms. Gita Todkar	Anatomy 2
2	Ms. Saba Bagwan	Physiology 2 and Clinical Biochemistry 1
3	Ms. Shanta Waghmode	Laboratory Basics 2 And Waste Management 2
4	Ms. Ankita Parab	Soft Skills
5	Dr vikram Salunke	Health and Wellness II

2. Title of degree program - BVoc Medical Imaging Technology (MIT)

Total students enrolled- 22

Total student's at 2nd semester - 19

Table on faculty involved (2nd semester)

Sl no	Name of faculty	Topic taught
1	Ms. Varsha R	Radiology-Equipment, Positioning Techniques and Procedures
2	Ms. Ankita Parab	Contrast Media in Diagnostic Radiology
3	Ms. Ankita Parab	Radiology - Quality Control and Patient Care
4	Ms. Ankita Parab	Soft Skills
5	Dr Vikram Salunke	Health and Wellness II

3. Title of diploma program - Postgraduate Diploma Medical Laboratory Technology (MLT)

Total students enrolled – 74

Total student's at 2nd semester - 54

Table on faculty involved (2nd semester)

Sl no	Name of faculty	Topic taught
1	Mrs. Gita Todkar	Anatomy
2	Mrs. Pooja Garje	Physiology and Laboratory
3	Ms. Snehal Sutar	Phlebotomy and Waste Management
4	Ms. Saba Bagwan	Biochemistry and Lab Ethics
5	Ms. Shanta Waghmode	Hematology and Immunology
6	Ms. Saniya Patel	Parasitology and Toxicology

March 2022 : Admissions

1. Title of degree program - BVoc Medical Image Technology (MIT)

No of students - 10

Table on faculty involved (1st semester)

Sl no	Name of faculty	Topic taught
1	Ms. Pooja Chavan	Anatomy and Physiology
2	Ms. Ankita Parab	Clinical pathology
3	Ms. Ankita Parab	Radiation Physics and Image Processing Techniques
4	Dr vikram Salunke	Health and Wellness-1
5	Ms. Sujata Salokhe	Digital Skills
6	Mr. Siddharth Bhingarkar	Communicating in English

2. Title of degree program - BVoc Medical Laboratory Technology (MLT)

No of students - 66

Table on faculty involved (1st semester)

Sl no	Name of faculty	Topic taught
1	Mrs. Gita Todkar	Anatomy 1
2	Ms. Saba Bagwan	Physiology 1 and Laboratory Basics 1
3	Ms. Snehal Sutar	Phlebotomy and Waste Management 1
4	Dr Vikram Salunke	Health and Wellness-1
5	Ms. Sujata Salokhe	Digital Skills
6	Mr. Siddharth Bhingarkar	Communicating in English



Students undergoing weekly one day theory classes



MLT students undergoing OJT at SKP



PGD MLT student at OJT



Accounts and Financial Statements


THE UNIVERSITY OF TRANSDISCIPLINARY HEALTH SCIENCES & TECHNOLOGY
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064

BALANCE SHEET AS AT MARCH 31, 2022

CORPUS FUNDS, CAPITAL FUNDS & LIABILITIES	SCH REF	As at 31st March 2022		PROPERTIES & ASSETS	SCH REF	As at 31st March 2021	
		Rs.	Rs.			Rs.	Rs.
General Fund	A	3,69,72,124	3,20,35,902	Property, Plant & Equipments	G	1,58,13,063	1,11,62,447
Corpus Fund	B	4,33,31,100	90,20,000	Investments	H	9,34,91,420	4,86,92,070
Reserves	C	1,01,08,901	50,09,634	Fixed deposits / Bonds			
Project Grants	D	2,60,55,735	4,61,88,328	Assets, Loans and Advances			
Current Liabilities	E	53,20,498	19,62,861	Cash on hand	I	3,40,49,792	5,768
Non-Current Liabilities	F	2,71,56,028	28,62,946	Balances with Banks	J	55,22,170	2,49,65,779
				Other Current Assets	K	67,941	1,16,08,162
				Advances			6,45,445
Total		14,89,44,386	9,70,79,671	Total		14,89,44,386	9,70,79,671

Notes A) to K) referred to above and Notes to the Consolidated Financial Statements (Note P) form an integral part of this Balance Sheet.

For The University of Trans-Disciplinary Health Sciences & Technology


(Prof. Anant Darshan Shankar)
Vice-Chancellor



(Mr. Suresh Hegde)
Joint Registrar - Finance & Accounts



As per our report of even date attached

For LAWRENCE TELLIS & ASSOCIATES
CHARTERED ACCOUNTANTS
(FIRM REGISTRATION NO. 0018575)



(Rohan Miranda)
Partner
ICAI M. No. 022772

Place: Bangalore
Date : 16/09/2022

THE UNIVERSITY OF TRANSDISCIPLINARY HEALTH SCIENCES & TECHNOLOGY
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064

STATEMENT OF INCOME AND EXPENDITURE FOR THE YEAR ENDED 31ST MARCH 2022

(Amount in Rs.)

Income	Grants/Project Income (Schedule L)	University Income (Schedule M-1)	Total Income	Previous Year's Total (FY 20-21)	
Consultancy Income	40,65,000	35,23,500	75,88,500	58,75,653	
Donations	1,12,61,500	2,47,49,173	3,60,10,673	2,90,41,216	
University Course Fees	-	1,22,79,792	1,22,79,792	24,84,100	
Training Income	72,24,459	17,20,623	89,45,082	1,75,25,424	
INCOME FROM OTHER SOURCES					
-Hostel & Guest House Charges	22,08,000	24,23,677	46,31,677	4,07,925	
-Miscellaneous Income	-	9,24,398	9,24,398	2,433	
-Transport & Other Recoveries	-	4,53,911	4,53,911	4,35,644	
INTEREST EARNED					
-Interest on Fixed Deposits	1,14,083	41,09,312	42,23,395	25,20,034	
-Interest on Savings Bank Accounts	3,07,148	5,23,654	8,30,802	7,39,659	
-Interest on Income Tax Refund	-	2,03,176	2,03,176	-	
Fees on Projects (Contra)	-	54,34,664	54,34,664	30,79,630	
TOTAL INCOME A]	2,51,80,190	5,63,45,880	8,15,26,070	6,21,11,718	
Expenditure	Grants/Project Expenses (Schedule N)	University Expenses (Schedule O)	Total Expenditure	Previous Year's Total (FY 20-21)	
Books, Periodicals & Other Literature	21,346	15,931	37,277	14,530	
Communication Costs	19,784	1,17,763	1,37,547	2,97,306	
Consultants & Outsourcing Services	76,40,931	1,13,99,301	1,90,40,232	1,23,84,749	
Consumables	17,30,612	2,43,053	19,73,665	17,40,597	
Field Work & Trials	9,44,792	12,00,806	21,45,598	1,51,361	
Gratuity Expenses	-	6,30,161	6,30,161	3,70,516	
IT Hardware, Software & Services	94,550	2,82,022	3,76,572	6,59,059	
Maintenance, Utilities, Repairs & Improvements	58,167	1,29,79,795	1,30,37,962	1,12,19,410	
Meeting, Conferences & Workshops	3,26,597	1,51,099	4,77,696	64,332	
Other Overheads & Contingencies	19,11,679	7,71,544	26,83,223	21,78,755	
Printing & Stationery	2,54,910	3,30,315	5,85,225	49,01,531	
Salaries Including Fellowships	2,27,87,842	2,10,79,889	4,38,67,731	3,75,06,850	
Travel & Conveyance	40,90,464	4,38,864	45,29,328	9,98,512	
Fees on Projects (Contra)	47,31,567	7,03,097	54,34,664	30,79,630	
SUB TOTAL B-1]	4,46,13,241	5,03,43,640	9,49,56,881	7,55,67,138	
Depreciation (Schedule G)	B-2]	-	28,65,522	28,65,522	23,18,979
TOTAL EXPENDITURE B] = B-1] + B-2]	4,46,13,241	5,32,09,162	9,78,22,403	7,78,86,117	
EXCESS / (DEFICIT) OF INCOME OVER EXPENDITURE FOR THE YEAR C] = A] -	(1,94,33,051)	31,36,718	(1,62,96,333)	(1,57,74,399)	

STATEMENT OF I & E (PAGE1)



THE UNIVERSITY OF TRANSDISCIPLINARY HEALTH SCIENCES & TECHNOLOGY
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064


STATEMENT OF INCOME AND EXPENDITURE FOR THE YEAR ENDED 31ST MARCH 2022


Income	Grants/Project Income	University Income	Total Income	(Amount in Rs.) Previous Year's Total (FY 20-21)
Excess / (Deficit) of Income over Expenditure for the year b/d	(1,94,33,051)	31,36,718	(1,62,96,333)	(1,57,74,399)
Appropriations:	-	-	-	-
Project income transferred to the respective Project (Grants) Funds (Schedule D)	2,51,80,190	-	2,51,80,190	2,40,77,863
Project Income Recognition (to the extent of project funds / grants utilised as in Schedule D)	(4,46,13,241)	-	(4,46,13,241)	(4,32,49,381)
Depreciation for the year on assets acquired through project funds transferred to Reserves for Fixed Assets (Schedule C)	-	(17,99,504)	(17,99,504)	(11,30,859)
Excess of Income over Expenditure for the year transferred to General Fund (Schedule A)	-	49,36,222	49,36,222	45,27,978
TOTAL	(1,94,33,051)	31,36,718	(1,62,96,333)	(1,57,74,399)

Schedules A, C, D, G, L, M, N & O referred to above and Notes to the Consolidated Financial Statements (Schedule P) form an integral part of this Statement of Income and Expenditure.

For The University of Trans-Disciplinary Health Sciences & Technology


(Prof. Anant Darshan Shankar)
Vice-Chancellor


(Dr. A.K. Gupta)
Chief Operating Officer & Registrar,
Dean


(Mr. Suresh Hegde)
Joint Registrar - Finance & Accounts



As per our report of even date attached

For LAWRENCE TELLIS & ASSOCIATES
CHARTERED ACCOUNTANTS
(FIRM REGISTRATION NO. 001857S)

(Rohan Miranda)
Partner
ICAI M. No 022772



Place: Bangalore
Date : 16/09/2022

END OF STATEMENT OF I & E
(PAGE2)

LAWRENCE TELLIS & ASSOCIATES
Chartered Accountants
No. 44/45, 2nd Floor, Panchyaka Complex
Residency Cross Road, Bangalore - 560 025
Ph.: 41514791/92/93
(FIRM ICAI REGN. No. 001857S)

THE UNIVERSITY OF TRANSDISCIPLINARY HEALTH SCIENCES & TECHNOLOGY
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064

RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2022

(Amount in Rs.)

Receipts	Grants/Project	University	Total	Previous Year's Total (FY 20-21)
OPENING BALANCES AS ON 01/04/2021			-	-
Bank Balances (Schedule I)	8,91,305	2,40,74,474	2,49,65,779	2,37,75,320
Cash Balances	-	5,768	5,768	6,302
	Grants/Project Receipts	University Receipts	Total Receipts	
RECEIPTS DURING THE YEAR				
Consultancy Income	66,11,279	29,09,786	95,21,065	35,43,761
Donations	1,12,61,500	2,47,49,173	3,60,10,673	2,90,41,216
Corpus Donations	-	3,43,11,100	3,43,11,100	90,20,000
University Course Fees	-	1,22,79,792	1,22,79,792	24,84,100
Training Income	1,06,80,371	17,46,583	1,24,26,954	1,29,58,916
INCOME FROM OTHER SOURCES				
-Hostel & Guest House Charges	22,08,000	24,23,677	46,31,677	5,30,425
-Miscellaneous Income	-	12,44,398	12,44,398	2,433
-Transport & Other Recoveries	-	4,53,911	4,53,911	4,35,644
INTEREST EARNED				
-Interest on Fixed Deposits	1,29,359	45,53,930	46,83,289	20,71,371
-Interest on Savings Bank Accounts	3,07,148	5,23,654	8,30,802	7,39,659
-Interest on Income Tax Refund	-	2,03,176	2,03,176	-
Project Grants received	64,64,466	-	64,64,466	3,91,94,460
OTHER RECEIPTS DURING THE YEAR				
Long Term Interest Free Loan	-	1,00,00,000	1,00,00,000	-
Long Term Refundable Security Deposits	-	12,30,000	12,30,000	-
TDS/TCS Refund Received	-	21,21,274	21,21,274	-
Refund/Settlement of Advances paid earlier	80,000	5,04,172	5,84,172	3,97,052
Refundable Credits received	-	2,60,720	2,60,720	3,110
Advance from Foundation for Revitalisation of Local Health Traditions	-	1,30,63,082	1,30,63,082	-
Investments matured during the year	10,08,945	20,00,000	30,08,945	50,84,953
Fees on Projects (Contra)	-	54,34,664	54,34,664	30,79,630
Inter-Unit Transfers (Contra)	1,32,34,939	-	1,32,34,939	1,18,08,335
TOTAL RECEIPTS	5,28,77,312	14,40,93,334	19,69,70,646	14,41,76,687

Payments	Grants/Project Payments	University Payments	Total Payments	Previous Year's Total (FY 20-21)
PAYMENTS DURING THE YEAR				
Books, Periodicals & Other Literature	21,346	15,931	37,277	14,530
Communication Costs	19,784	1,21,823	1,41,607	2,61,310
Consultants & Outsourcing Services	81,25,631	95,33,069	1,76,58,700	1,09,38,470
Consumables	17,30,606	2,43,053	19,73,659	13,83,640
Field Works & Trials	9,61,137	12,00,806	21,61,943	1,35,016
Gratuity Expenses	-	10,33,093	10,33,093	4,94,022
IT Hardware, Software & Services	94,550	2,93,790	3,88,340	6,59,059
Maintenance, Utilities, Repairs & Improvements	58,167	1,27,90,108	1,28,48,275	1,15,78,423
Meetings, Conferences & Workshops	3,26,597	1,51,099	4,77,696	64,332
Other Overheads & Contingencies	19,10,869	7,37,780	26,48,649	20,95,345
Printing & Stationery	2,54,910	3,30,315	5,85,225	48,98,935
Salaries including Fellowships	2,27,87,842	2,10,79,888	4,38,67,730	3,75,57,889
Travel & Conveyance	40,89,879	4,45,933	45,35,812	9,91,443
Advances for Purchases	-	2,360	2,360	3,89,931
Refund of un-utilised Project Grants	910	-	910	2,87,914
Purchase of Fixed Assets	65,08,840	6,17,367	71,26,207	28,95,369
	c/fd	4,68,91,068	4,85,96,415	9,54,87,483
TOTAL PAYMENTS	4,68,91,068	4,85,96,415	9,54,87,483	7,46,45,628



R & P A/C (PAGE1)

THE UNIVERSITY OF TRANSDISCIPLINARY HEALTH SCIENCES & TECHNOLOGY
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064


RECEIPTS AND PAYMENTS ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2022

(Amount in Rs.)

Payments	Grants/Project Payments	University Payments	Total Payments	Previous Year's Total (FY 20-21)
b/fd	4,68,91,068	4,85,96,415	9,54,87,483	7,46,45,628
OTHER PAYMENTS DURING THE YEAR				
Loans & Staff Advances	-	28,702	28,702	2,06,945
Refund of Caution Deposits received	-	75,000	75,000	-
TDS/TCS recovered during the year	3,633	7,07,860	7,11,493	6,50,503
Statutory payments	-	-	-	1,44,156
Investments during the year (Schedule H)	1,25,726	4,76,82,569	4,78,08,295	2,03,77,070
Refund of Advance received from FRLHT	-	-	-	79,29,239
Excess GST/TDS deposited	-	1,40,278	1,40,278	3,63,634
Fees on Projects (Contra)	47,31,567	7,03,097	54,34,664	30,79,630
Inter-Unit Transfers (Contra)	-	1,32,34,939	1,32,34,939	1,18,08,335
	Grants/Project	University	Total	
CLOSING BALANCES AS ON 31/03/2022				
Bank Balances (Schedule I)	11,25,318	3,29,24,474	3,40,49,792	2,49,65,779
Cash Balances	-	-	-	5,768
TOTAL PAYMENTS	5,28,77,312	14,40,93,334	19,69,70,646	14,41,76,687

For The University of Trans-Disciplinary Health Sciences & Technology


 (Prof. Anant Darshan Shankar)
 Vice-Chancellor


 (Dr. A.K. Gupta)
 Chief Operating Officer & Registrar,
 Dean


 (Mr. Suresh Hegde)
 Joint Registrar - Finance & Accounts



As per our report of even date attached
 For LAWRENCE TELLIS & ASSOCIATES
 CHARTERED ACCOUNTANTS
 (FIRM REGISTRATION NO. 001857S)

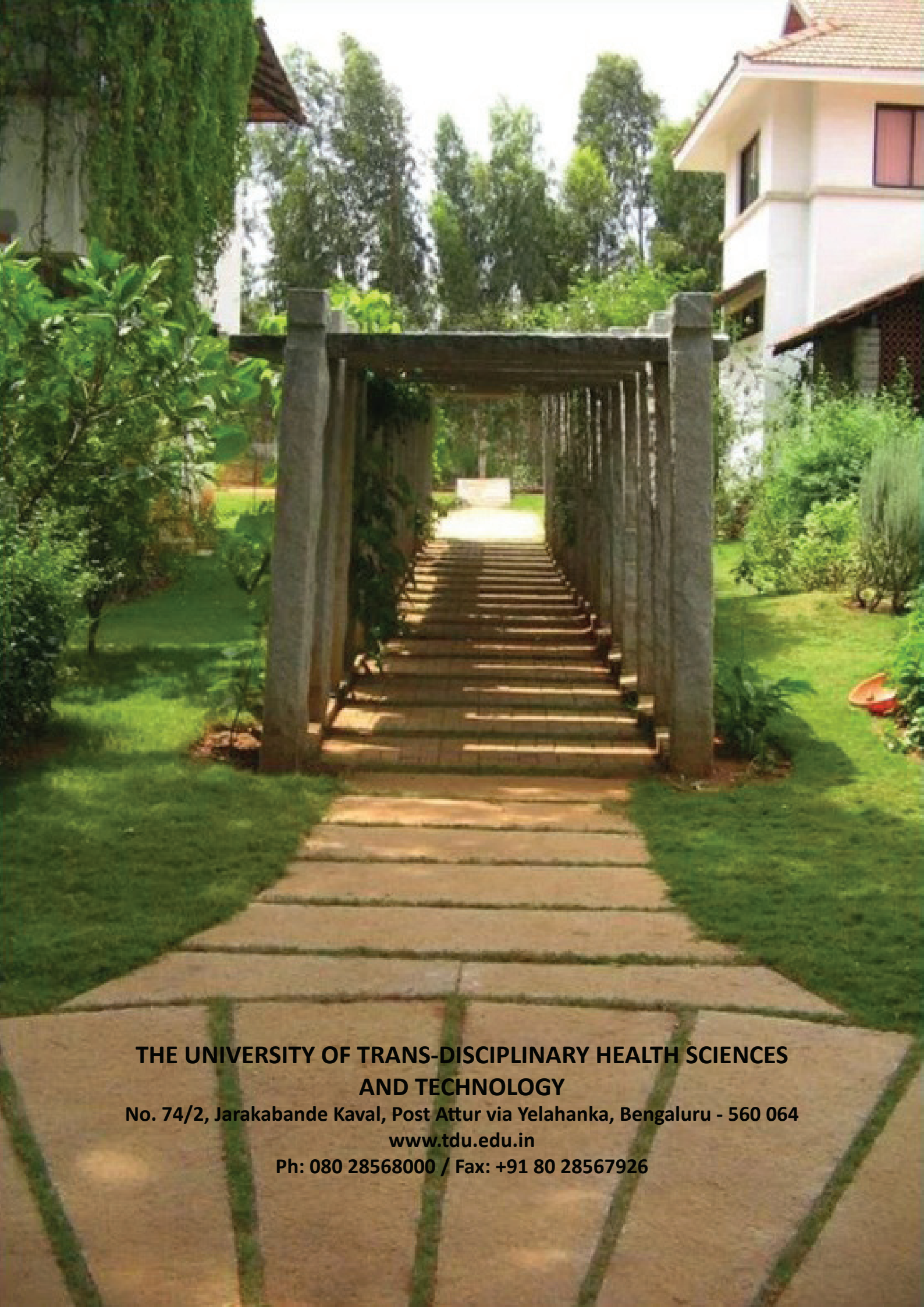

 (Rohan Miranda)
 Partner
 ICAI M. No 022772



Place: Bangalore
 Date : 16/09/2022

END OF R & P A/C (PAGE2)

LAWRENCE TELLIS & ASSOCIATES
 Chartered Accountants
 No. 44/45, 2nd Floor, Bangalore Complex
 Residency Cross Road, Bangalore - 560 025
 Ph.: 41514791/92/93
 (FIRM ICAI REGN. No. 001857S)



**THE UNIVERSITY OF TRANS-DISCIPLINARY HEALTH SCIENCES
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