



THE UNIVERSITY OF TRANS-DISCIPLINARY
HEALTH SCIENCES & TECHNOLOGY



Annual Report

2017-18



Werner kulhbrandt



Richard Henderson

Nobel Laureates visited TDU



One of the 110 Medicinal Plant Conservation Area (MPCA)



National Herbarium of Medicinal Botanicals



Ayurveda Biology Laboratory



Workshop on Functional Genomics for Professionals



International Folk Healers Conference



Community Participation in Sustainable Harvesting of Med. Plants



Mr. Ratan Tata visit to FRLHT



100 Bed Integrative Healthcare Center



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2017-2018



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Nobel Laureates visited TDU



Nobel laureates **Dr. Werner Kulhbrandt** and **Dr. Richard Henderson** Visited TDU on 26th January 2018. They were taken around all the Centres of TDU. They were highly appreciative of the work carried out by TDU.

Vision:

Social transformation through innovation inspired by Ayurveda, Natural and Social Sciences and Technology.

Mission:

Inspire minds of students and faculty to design, participate and execute innovative Trans-disciplinary socially impactful research, education and outreach programs in Integrative Health Sciences and other fields of knowledge.

Values:

Professionalism, Respect, Integrity, Dependability and Excellence (PRIDE)

Goals:

- Affordable, accessible and scalable solutions for unmet social needs
- Original knowledge contributions arising from interface of Traditional Knowledge and Modern Science.
- Innovations derived from domains of knowledge, mandated in the TDU Act.

Major Achievements : 1993-2018

- 1993: Conceived and guided establishment of 110 Medicinal Plant Conservation Areas across 13 States, to create the largest insitu Conservation program in the tropical world.
- 1995: Established India's only Computerized Database & Herbarium of Med Plants of India.
- 1995-2012: Contributed to all National AYUSH Five Year Plans as Member of Steering Committees, in the Planning Commission, wrote chapter on TK for National Knowledge Commission, Gol.
- 1998: Established grassroots network of folk healers across 9 States.
- 2000: Established Ayurveda-biology labs for bridging Shastra & Science.
- 2003: Supported design and establishment of thousands of herbal gardens across India.
- 2008: Put cataloguing and digitization of medical manuscripts on National Agenda and Catalogued 17000 out of an estimated 100000 medical manuscripts.
- 2010: Launched the Journal of Ayurveda and Integrative Medicine (JAIM) which is today globally amongst the top five Journals in the integrative healthcare space.

National and International awards

- In 1998, FRLHT received the prestigious **Norman Borlaug Award** for its contributions to Conservation of Medicinal Plants.
- In 2002 FRLHT was selected by the United Nations for the **Equator Initiative Prize**, for linking conservation to livelihood needs.
- Between 2002 & 2010, three Ministries of Govt. of India viz., Environment and Forest, Department of Science and Technology (DST) and Ministry of AYUSH, recognized FRLHT-TDU as a National Central of Excellence.
- In November 2003, the Medical School in Columbia University, New York, awarded FRLHT with its first International award for cultural **Leadership in Traditional Medicine**.
- In 2011, the Govt. of India conferred **Padma Shri** to the Founder Director of FRLHT.
- In 2018, the All Party Parliamentary Group, UK awarded **Ayurveda Ratna** to TDU.

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Message from the Chancellor and Vice Chancellor



The year 2017-18 is the twenty-fourth year of our existence. Next year will commence the twenty-fifth year of the FRLHT-TDU institution. In 2018-19 we will celebrate our twenty-fifth anniversary.

In 2013, FRLHT evolved into the Trans-Disciplinary University (TDU). The act explicitly mandates TDU to seed a "research university". We believe TDU is yet to reach optimum level of functioning as a research University. Our first priority must be to increase the number of research students across the six research centres of the University. Young minds engaged in doctoral and master's by research programs will add quality and speed. We must try to enroll on the average, around 15 research students per Centre and thus have around 100 students in the next 3 years. This number should go up to around 250 students over the next five years.

We wish the Trans-Disciplinary University (TDU) to grow into a world class research university focused on its pioneering and ambitious core agenda of revitalization of India's medical heritage. We believe we can build creatively upon our current focal areas like insitu conservation of medicinal resources, theoretical foundations of Ayurveda, Traditional Knowledge Informatics, Ayurveda Biology, Functional Genomics, strengthening village based Local Health Traditions and Clinical Medicine.

We are proud of our unique achievements. The national herbarium of medicinal botanicals is the only national facility in the domain of medicinal plants. Our multi-disciplinary databases on medicinal plants and traditional knowledge documented from 1500 BC to 1900 AD is one of its kind. We have created modest scientific facilities for phyto-chemistry, micro-biology, cell-biology and functional genomics. In collaboration with 13 State Forest Departments we have technically guided the creation of the world's largest network of 110 insitu conservation reserves. We have motivated communities across 9 States to create taluka level folk healer networks. The 100 bed research hospital on campus supported by the Tata Trusts is perhaps amongst the best in the country. The quality of these creations on our campus and in ecosystems and communities in several States have created public confidence in the contemporary relevance of our heritage.

Reviewing this year's performance we feel satisfied with the design and progress of the Knowledge Commission supported project for developing a taluka specific herbal pharmacopeia, on an ICT platform. We expect this program will demonstrate an innovative healthcare strategy to reduce dependence on institutionalized healthcare by empowering thousands of households to manage primary healthcare using ecosystem specific plant resources. The Functional Genomics and Bio-informatics center formed this year is an important milestone in our journey to bridge modern science and Ayurveda.

We are grateful to the Infosys foundation for its long term "seed corpus" support to our program on conservation and sustainable use of medicinal botanicals. The Master's program (MSc) in conservation futures initiated this year, is a learning experience in formal academics. It will form the basis of several specialized master's by research programs we intend to launch in the years ahead.

The work of our colleagues in the ethno-veterinary field is heartening. It is demonstrating safe, low cost herbal remedies for treating cattle for wide spread conditions like mastitis, enteritis, FMD, repeat breeding, infertility, fever, and udder pox. The program has reduced the dependence of dairy farmers on anti-biotics which enter the food chain and effect both the product quality and consequently human health.

The Centre for LHT in 2017-18 has entered into a strategic partnership of Quality Council of India and launched a National Certification and Accreditation Scheme based on ISO standards, for village based folk healers. This is a pioneering project to certify village healers as reliable traditional community health workers. This is a very important initiative with nationwide scope, to enhance health security of rural communities. We have also initiated towards the end of this year a novel certificate program for training barefoot elephant herbal healers, trained in the great tradition of *Pashu Ayurveda*.

The University hospital called Institute of Ayurveda and Integrative Medicine (I-AIM) attracts around 36000 customers annually. It continues to grow through the word of mouth of our satisfied customers. We manage a range of health conditions in areas like Dermatology, Oncology, Wellness and Metabolic disorders, Gastroenterology, Yoga and Meditation, Physiotherapy and Rehabilitation, Obstetrics and Gynecology, Para surgery, Nephrology, Paediatrics with special focus on children with developmental disabilities, Cardiac care, Liver care, Musculoskeletal disorders, Geriatrics, Neurology, Respiratory disorders, wellness, ENT, Ophthalmology and Dental care.

With the support of Biomerieux we have initiated a clinical study on Ayurvedic management of Urinary Tract Infections (UTI) without the use of anti-biotics and the outcomes appear to be promising. Our clinical findings on neurological conditions like Strokes, Parkinson's, wound healing, dry eyes syndrome and CKD are promising

We believe our progress in terms of inputs versus output is impressive but in terms of absolute growth in the context of University systems, it is small.

1 Centre for Conservation of Medicinal Resources

The centre for conservation of medicinal resources is engaged in activities focused on conservation and such as sustainable use of medicinal plants, development of national herbarium and raw drug repository, environmental and information system. During the year 2017-2018, following projects were executed:

1.1 Insitu conservation: Review of West Bengal Program

The main objective of establishing a nationwide network of MPCAs across different ecological zones is to conserve intra-specific gene pools of threatened and endemic medicinal plants, with special focus on species that are known to be in high volume trade because if their gene pools are not urgently conserved it may accelerate their extinction. The conservation of the gene pools of threatened species is expected to be done in at least one and at times in more than one hotspot of their genetic diversity. The number of MPCAs needed to conserve gene pool of a particular species depends on the extent of its distribution range. An endemic species for example may require only one MPCA to conserve its gene pool, however a widely distributed species may require several MPCAs to capture its diverse gene pool.

The central purpose of the MPCA program is in-situ conservation of the genetic diversity of wild populations of highly traded species with special focus on endemics and threatened species in order to firstly ensure their long term survival and secondly to provide access to breeders of reproductive material for selection, breeding and for ex situ cultivation of herbs and small life forms and in case of tree species for plantations.

The current project is to evaluate status of the 7 (seven) MPCAs already established in West Bengal under UNDP supported project during 2007-2009. The study aims to initiate the iterative process to analyze the strengths and gaps in the MPCA program of West Bengal and suggest additional measures to strengthen the program. The data collected in 2007 during the establishment phase of the 7 MPCAs in West Bengal was not sufficient to carry out a critical assessment of numbers of MPCAs needed in the State or their precise hotspots of genetic diversity because at that early inception stage the conceptualization of the MPCA program was still evolving, as indeed it will continue to do even in future years post 2018 from past and ongoing learnings of limitations of strategy and outcomes during execution.

1.2 Sustainable use of Natural and Medicinal Plant resources

1.2.1 Develop Innovative tools, Techniques, and Methods to improve the harvesting of several important forest NTFPs in Shimoga District, Karnataka.

Project is funded by USAID, under Forest PLUS programme in India.

Relevance of the project:

This project was implemented in 4 Village Forest Committees (VFCs) viz., Kikkeri in Shivamogga Forest Division and Aramanekoppa, Maruthipura and Sulugodu in Sagara Forest Division, Karnataka for 3 species viz., *Ailanthus triphysa*, *Cinnamomum malabatum* and *Sapindusemarginatus*. This project was completed in 2016-17.

Highlights of progress/ achievements:

During 2017-18, two third party reviews of field implementation of the project were carried out, where TDU coordinated with the review agency by providing technical details of the project and its outcomes.

- 1st review cum project impact assessment was carried out on 26th July 2017. Reviewers analysed the impact of the project in the field by visiting the VFCs and interacting with the stakeholders
- 2nd review was organized on 1st November 2017. The reviewers recorded tangible and intangible benefits to the community from the project. Interviewed the stakeholders to understand the project outcomes and economic benefits accrued from this project.
- The positive impact of this project has increased the probability of receiving funds for the 2nd phase of the USAID project.



Reviewers are interacting with the stakeholders



Reviewers in the field to understand the impact of the project

Publication: Jagannatha Rao, G.B. Deepa, H.M. Suresh, Arthur Selwyn Mark and M.B. Naik, 2017, Partnership for Land Use Science: Forest – PLUS programme, Develop innovative tools, techniques, and methods to improve the harvesting of several important forest NTFPs in Shivamogga landscape, Karnataka, India, USAID and TDU.

Invited talk: invited talk on Sustainable Management of Forests: field interventions in the forestry in Western Ghats, India at international conference on sustainable landscapes and forest ecosystems, New Delhi, on 12th and 13th September, 2017, USAID. Presented by Jagannatha Rao, R

Team Members:

Mr. Jagannatha Rao R., Associate Professor and PI

Ms. Deepa GB, Assistant Professor and Co-PI

Sustainable use of Natural and Medicinal Plant resources

1.2.2 Generation of Livelihood Opportunities for the Local Communities in Savanadurga by Sustainably Utilising the Natural Resources

Funded by National Medicinal Plants Board (NMPB) through Karnataka Forest Department

This project is being implemented in four Joint Forest Management Committees (JFMCs) viz., Dabbaguli, K.V. Matha, NayakanaPalya and Polohalli in Magadi forest range of Ramanagara District, Karnataka that are the fringe villages around Savanadurga Medicinal Plants Conservation Area (MPCA). This project aims at providing economic benefits to the local community by using the medicinal plant resources thereby involving them in long term conservation activities.

Highlights of the progress:

- Coordinated the mid-term project review conducted by National Productivity Council that was identified by National Medicinal Plants Board (NMPB), New Delhi.
- Provided technical support to the Karnataka Forest Department in field implemented the sustainable harvesting techniques for selected medicinal plants such as leaves of *Gymnemasylvestre* and fruits of *Tamarindusindica* (Tamarind).
- Carried out a series of meetings with organic certification agency and forest department staff for organic certification of wild produces. Compilation of documents for the purpose of organic certification is in progress.



Field visit to medicinal plants collection area by the certifying agency



Review team visited the project site

Publications:

1. **Deepa GB**, Jagannatha R. Rao and Arthur Selwyn Mark. 2017. Global and national initiatives on policies and regulatory measures for conservation and sustainable use of medicinal and aromatic plants. In: Medicinal Plants: Benefit sharing, development, conservation; Ed., Pradeep Kumar S., Amruth M., Raghu AV, Md. Kunhi KV and Raveendran VP, KSCSTE-Kerala Forest Research Institute, Peechi. ISBN: 978-81-85041-88-1
2. **Deepa GB**. 2017. Policy brief on “New Form of Sustainable Tourism – Medicinal Plant Conservation Areas” published on www.edu.edu.in on International Biodiversity Day, 2017.

Team Members:

Ms. Deepa GB, Assistant Professor, PI

Mr. Jagannatha Rao R., Associate Professor, Co-PI

Ms. Rajashree G. Mavinkurve, Assistant Professor, Team Member

Sustainable use of Natural and Medicinal Plant resources

1.2.3 Sustainable Harvesting, Value Addition, Warehousing and Marketing of Selected RET and High Traded Medicinal Plant Species Covering 22 JFMCs in 18 Forest Divisions of Karnataka, India Department

Funded by National Medicinal Plants Board (NMPB), Govt. of India through Karnataka Forest Department

Relevance:

Project sponsored by National Medicinal Plants Board (NMPB) implemented in Karnataka in collaboration with Karnataka Forest Department (KFD) supports basic infrastructure facilities like storage godown, drying yard, equipment and revolving fund to improve the quality of raw drugs through community participation by promoting Good Collection practices. Further, supports to generate fair price for the semi-processed produce and an additional income through market linkage at Joint Forest Management Committee (JFMC) level with the technical support of TDU.

Highlights of Progress:

- A team from National Productivity Council, NMPB External Project Monitoring visited all the 22 JFMC to monitor the progress of the project and sent a report to NMPB.
- Buyer-sellers interactive meeting on providing market linkage to sustainably collected raw drugs were organized in collaboration with KFD and KaMPA in Belgaum on 31st January 2018 at Belgaum, where 150-200 participants from Herbal Industry, Forest Department VFC members participated and Ayurveda students during the meet
- Submitted the progress report, statement of expenditure and UC for the financial year 2016-17, request for release of 2nd installment sent to carry out further activities
- Monitored sustainable collection of *Terminalia chebula* in Kaduboranhalli JFMC in Tumkur District, Karnataka.
- Organised market linkage to the sustainably collected fruits of *T. chebula*.



Fruits of *Terminalia chebula* stored in the godown

It was sold at Rs. 13/kg as compared to the market value of Rs.9/ kg of fruits.

This price appreciation was because of following good collection practices including post harvest techniques which yielded high quality of fruits.

Invited talks: Invited talk on Sustainable use of NTFPs, in the interactive meeting organized by Karnataka Forest Department, KaMPA and KBB on 12th Dec 2017, presented by Jagannatha Rao R. Invited paper presentation by Ms. Rajashree G. Mavinkurve, Assistant Professor on “Traditional Medicinal Plant Wealth - its Conservation, Utilization and Bio-prospect” at National Interaction Meeting of Practitioners and Researchers of Traditional Systems of Medicine –13th October, 2017, KFRI, Peechi, Kerala

Invited talk by Ms. Rajashree G. Mavinkurve, Assistant Professor on “Sustainable Collection and Value Addition of Medicinal Plants used in primary Health care” in a Workshop on Primary Health Care Practices and Sustainable Collection and Value Addition of Medicinal Plants from wild was organized at

Sustainable use of Natural and Medicinal Plant resources

Dr. A. V. Baliga College, Kumta on 19-01-2018. The workshop was organized for healers, VFC Members, Students of College and Department staff of Honnavar Forest Division

Ms. Rajashree G. Mavinkurve, Assistant Professor was invited by KaMPA to present on the NMPB-KFD Value Addition project during the Buyer-sellers interactive meeting on providing market linkage to sustainably collected raw drugs, organized in collaboration with KFD and KaMPA in Belgaum on 31 st January 2018 at Belgaum

Team Members

Mr. Jagannatha Rao R: PI

Ms. Rajashree G. Mavinkurve: Co PI

Ms. Deepa G. B.: Team Member

1.2.4 Resource Augmentation of selected RET and High Traded Medicinal Plant species Covering 22 JFMCs in 18 Forest Divisions of Karnataka, India funded by National Medicinal Plants Board (NMPB) through Karnataka Forest Department

Relevance:

Project sponsored by National Medicinal Plants Board (NMPB) implemented in Karnataka in collaboration with Karnataka Forest Department (KFD) supports for Plantation including maintenance, soil-moisture conservation, Awareness programmes, micro-planning, fencing, monitoring and evaluation and entry point activities to conserve selected species in each of the 22 JFMCs for the same JFMC selected for the project on Sustainable collection and Value Addition project through Artificial Regeneration (AR) and Aided Natural Regeneration (ANR) models. This helps in conservation and restoration of Gene pool of selected Medicinal plants with the technical support of TDU. Project contributes for Raw material security of selected medicinal plants to AYUSH industries.

Highlights of Progress:

- Organized periodic review meetings at KFD attended by APCCF (Development), CCF (NAFP and BM) and others A team from National Productivity Council, NMPB External Project Monitoring visited all the 22 JFMC to monitor the progress of the project and sent a report to NMPB
- Submitted the progress report, statement of expenditure and UC for the financial year 2016-17, request for release of 2 nd installment sent to carry out further activities

Team Members

Mr. Jagannatha Rao R: PI

Ms. Rajashree G. Mavinkurve: Co-PI

Ms. Deepa G. B.: Team Member

Sustainable use of Natural and Medicinal Plant resources

1.2.5 Capacity building of MFP collectors of Chhattisgarh Minor Forest Produce Federation (CGMFPP) on good collection practices of nationalized and non-nationalised MFPs in Chhattisgarh Funded by Chhattisgarh Minor Forest Produce Federation Cooperative Limited, Raipur

Relevance:

Chhattisgarh has established **Chhattisgarh State Minor Forest Produce Federation** for organizing collection and marketing of nationalized and non-nationalised Non-Timber Forest Produces (NTFPs). 915 primary cooperative societies spread in all the 6 forest circles are engaged in collection and marketing of NTFPs. This project has attempted to train the primary collectors on good collection practices that include sustainable collection, value addition, post harvesting techniques and marketing of NTFPs.



Interaction with NTFP collectors

Highlights of the progress:

- During 2017-18 organised a field visit to different primary cooperatives to understand the training needs.
- Short listed 15 species for development of good collection practices.

Team Members:

Mr. Jagannatha Rao R., Associate Professor and PI
Ms. Deepa GB, Assistant Professor and Co-PI

1.2.6 Sustainable harvesting, value addition, warehousing and marketing of selected RET & high traded species in Peechi and Silent Valley Wildlife Divisions, Kerala (JFMC/KE-01 & 02/2016), funded by NMPB, New Delhi, through Kerala Forest and Wildlife department, Government of Kerala

This project is aimed to implement the good collection practices of medicinal plants especially conservation concern species collected from nine Eco-Development Committee (EDC) areas through regular training and capacity building activities targeting the local collectors. Besides, in this project, collectors are provided support to perform value additions locally, and are also given market linkage to trade their collections for a good price. In this project, the TDU offers technical support to implementing agency i.e. Kerala Forests and Wildlife Department.

Highlights of progress:

- Documented the baseline data of medicinal plants collected and their quality, marketing, etc. from nine EDCs, a team of 10 to 15 members, called Task team, was formed in each EDC to implement GCPs for wild collection of 14 prioritised medicinal plant species
- The details of collectors were documented in each EDC and collectors were given identity cards
- Training & capacity building programmes on implementing GCPs in the field were periodically organized for local collectors, local community institutions, and front line staff of

Sustainable use of Natural and Medicinal Plant resources

Forest Department through communication materials such as posters and fact sheets related to GCPs for medicinal plants

- The arrangement of direct marketing of NTFPs/medicinal plants through lining industries and collectors through FDA was initiated
- The identified buyers were visited and oriented on the project activities and they were invited to participate in an interactive meeting of buyers and sellers to discuss the modalities to facilitate direct procurement of raw drugs from tribal collectors.
- Following to this meeting, a signing of MoU was arranged between selected herbal industries and Forest Development Agencies (FDAs) in Peechi and Silent Valley

Invited talk: invited talk by Jagannatha Rao R, Arthur Selwyn Mark and A.K. Pramod on Sustainable harvesting, value addition and marketing of wild medicinal plants: designing participatory methods and the process of field implementation – case study from Silent Valley and Peechi Wildlife Divisions in Kerala, during one-week training programmes organized at KSCSTE-KFRI on 'Conservation and Development of Medicinal Plants and Benefit Sharing with Local Communities' for the senior officers of the Indian Forest Service during 4-8 December, 2017

Publication: Arthur Selwyn Mark, Deep, G.B. and Jagannatha R. Rao. 2017. Sustainable harvesting, value addition and marketing of wild medicinal plants: designing participatory methods and the process of field implementation – case study from Silent Valley and Peechi Wildlife Divisions in Kerala. In: Medicinal Plants - Benefit Sharing, Development, Conservation. Kumar, P.S., Amruth, M, Raghu, A.V. (eds.) pp. 125-139.

Team members involved:

Mr. Jagannatha Rao, Associate Professor, Project Investigator

Dr. Arthur Selwyn Mark, Research Associate

Mr. A.K. Pramod, Field Coordinator

1.3 Herbarium and Raw Drug Repository of Medicinal plants used in ISM

1.3.1 Strategic initiatives for “Conservation of Medicinal Flora, associated with India's Medical Heritage” supported by Infosys

The botanical team confirmed the identity of herbarium specimens collected previously from states of Nagaland, Arunachal Pradesh, Manipur, Tamil Nadu and Andaman using regional and national floras, These specimens were labelled and digitized. Totally the collections corresponds to about 2,415 voucher specimens related to 600 plant species.

Some of the noteworthy rare and endemic plant species North East India (West Bengal and Manipur)

Sl.	Plant name	Family	Habit	Status*
1	<i>Agapetes borii</i> Airy Shaw	Ericaceae	Shrub	Endemic to Manipur
2	<i>Aristolochia tagala</i> Cham.	Aristolochiaceae	Climber	Rare
3	<i>Clerodendrum viscosum</i> Vent.	Verbenaceae	Undershrub	Rare
4	<i>Eranthemum pulchellum</i> Andrews	Acanthaceae	Shrub	Common
5	<i>Gomphostemma lucidum</i> Wall. ex Benth.	Lamiaceae	Herb	Common
6	<i>Gymnocardia odorata</i> R. Br.	Flacourtiaceae	Tree	Rare and Endemic
7	<i>Magnolia doltsopa</i> (Buch.-Ham. ex DC.) Figlar	Magnoliaceae	Tree	Rare
8	<i>Mahonia imbricata</i> T.S. Ying & Boufford	Berberidaceae	Shrub	Endemic to China
9	<i>Memecylon cerasiforme</i> Kurz	Melastomataceae	Shrub	Endemic to West Bengal
10	<i>Paramignya griffithii</i> Hook.f.	Rutaceae	Climbing	Rare
11	<i>Piper locnchites</i> Roem. & Sch.	Piperaceae	Herb Shrub	Rare to North East
12	<i>Pleione humilis</i> (Sm.) D.Don	Orchidaceae	Herb	Rare
13	<i>Trichodesma khasianum</i> C.B.Clarke	Boraginaceae	Shrub	Endemic to Manipur

* Rarity is provided based on the field survey

Rare and Endemic Plants



Magnolia doltsopa (Buch.-Ham. ex DC.) Figlar



Agapetes borii Airy Shaw



Tarennoidea wallichii (Hook.f.) Tirveng. & Sastre



Trichodesma khasianum C.B.Clarke



Clerodendrum viscosum Vent



Pleione humilis (Sm.) D.Don

Herbarium and Raw Drug Repository of Medicinal plants used in ISM

Different Forest types



Evergreen Forest from Manipur



Grass Land from Manipur



Deciduous forest from North West Bengal



Scrub forest from North West Bengal

1.3.2 Botanical/ ecological survey (diversity, distribution, ecology and status of wild medicinal plants) in HD Kote

Conducted botanical & ecological survey in selected villages of HD Kote Taluk and laid 76 transects in 23 tribal settlements across 8 different landscapes like Open forest, Degraded scrub land, Savanna, Teak plantation, Village pasture abandoned orchard, Fallow field homestead etc. The study resulted in recording 330 herbs (including grasses and seedlings), 92 trees and 161 shrubs and climbers. Collected 100 medicinal plants (collected from the wild) and herbarium specimens were prepared. Some of the important threatened and traded medicinal plants recorded in the study area are: *Aegle marmelos* (L.) Corrêa, *Embelia tsjeriam-cottam* (Roem. & Schult.) A.DC., *Gardenia gummifera* L.f., *Gloriosa superba* L., *Holostemma ada-kodien* Schult., *Oroxylum indicum* (L.) Kurz, *Santalum album* L.

Team members involved:

Dr. K. Ravikumar and
Dr. Anbarasan

Herbarium and Raw Drug Repository of Medicinal plants used in ISM

1.3.3 Dabur – Jivanti Welfare and Charitable Trust (JWCT) supported activities at the Foundation for Revitalization of Local Health Traditions (FRLHT):

Hands on training programs were conducted for the 2nd year Dravyaguna students of Sri Sri Ayurveda College (20th and 21st April 2017) and Ramakrishna Ayurveda College and Research, Bangalore (18th and 19th May 2017); SDM Ayurveda College, Bangalore, M.Sc. Student for Government Science College, Bangalore (6th and 13th December 2017). Orientation program on Medicinal plants and Biodiversity was conducted for the students of College of Forestry, Sirsi, Uttara Kannada District on 28th November 2017.

Team members involved:

Dr. S.Noorunnisa Begum,
Dr. K. Ravikumar, Ms. Preeti Singh

Developing Educational Display Material on Threatened Medicinal Plants: 19 poster on a Endemic Threatened Traded Medicinal Plant have been prepared and displayed for the benefit of students, researchers. 12 posters famous botanist/ foresters/ naturalist who contributed to the systematic enumeration of the Indian Plant Wealth has also been prepared and displayed in the repository. Posters on important forests in different parts of the country has also been developed.

The raw drug display has been expanded and added 35 metals and minerals to the repository.

1.3.4 Study on galls of Karkatashringi and bottlenecks in production of galls

Team members involved:

Dr. S.Noorunnisa Begum, Dr. K. Ravikumar, Mr. Patturaj Dr. Malali Gowda, Dr. N. Pavithra (FRLHT), Dr. Gurinder Singh, Dr. Vineet Jishtu and Mr. Brij Bhushan (Conifer Forest Research Institute, Shimla) and Mr. Amit Bhat (Dabur Pvt. Ltd.)

Population studies of *Pistacia chinensis subsp. integerrima* (J. L. Stewart ex Brandis) Rech. f. were enumerated in Bilaspur district (Ghumarvin, Brampukhar, Hamirpur, Namhol); Sirmour district (Lahrab, Shamlog, Tikri); Shimla district (Lower belt Keppu, Upper belt Mangsoo –Serti, Serti, Bagna); Kinnaur district (Satluj Catchment-Nigulseri to Wangtoo, Pashpa Rupi, Nigulseri); Solan district (Kandaghat, Sharog, Kararighat, Vaknaghat, Bhararighat, Chamakri-pool, Darlaghat and Shalaghat); Chamba district (Patka, Chuwari, Chamba town, Dhanoon, Madhuwar, Haripur, Pukhortu, Mehtar, Bhalaj; Kharamukh, Satli, Garola, Nayagran in Bharmour Forest Division and Kharamukh, Satli, Garola, Nayagran in Bharmour Forest Division; Kullu District (Beas and Satluj Catchment Largi, Sainj, Ropa and Niharni in Sainj Valley). The latitude, longitude, altitude and number of individuals were documented. The aphids were identified. The ethnobotanical uses, trade and various insects on the tree was studied and life cycle has been documented and observation will be continued next year too.

Developing Educational Display Material on Threatened Medicinal Plants: 19 poster on a Endemic Threatened Traded Medicinal Plant have been prepared and displayed for the benefit of students, researchers. 12 posters famous botanist/ foresters/ naturalist who contributed to the systematic enumeration of the Indian Plant Wealth has also been prepared and displayed in the repository. Posters on important forests in different parts of the country has also been developed.

The raw drug display has been expanded and added 35 metals and minerals to the repository.

Herbarium and Raw Drug Repository of Medicinal plants used in ISM

Other Activities:

Interns at Herbarium (FRLH)

Ms. Nikita Sethi and Ms. Nidhi Tomar, 2nd Year M.Sc. Biodiversity and Conservation, University School of Environment Management, Guru Gobind Singh Indraprastha University, Sector 16 C, Dwaraka, New Delhi completed summer internship under the guidance of Dr. S. Noorunnisa Begum, Associate Professor.

Authentication Services:

Authentication of drug samples and herbarium specimens were done for students of R.R. College of Pharmacy, Bangalore; National Institute of Unani Medicine – NIUM, Bangalore; Acharya Institute of Technology, Bangalore; SDM collage of Ayurveda, Hassan and Indian Institute of Technology, Chennai and industries such as Enovate Biolife Pvt Ltd and Indfrag Limited.

Publications/Research papers/ invited talks :

- Delivered talk on **Medicinal Plant wealth of India** to the P.G and U.G students from different streams of Life sciences at Padmashree Institute of Management and sciences on 2nd August 2017 on the eve of Science forum.
- Special lecture on **“Recent Trend in Taxonomy”** on 17th July 2017 at Periyar University, College of Arts and Sciences, Harur, Dharmapuri District, Tamil Nadu.

Publication:

K. Ravikumar, N. Dhatchanamoorthy, A. C. Tangavelou, T. S. Suma and S. Noorunnisa Begum. 2018. New Additions to the Angiospermic flora of Nagaland, India. © East Himalayan Society or Spermatophyte Taxonomy; *Pleione* 12(1): 118 - 127. doi:10.26679/Pleione.12.1.2018.118-127.

K. Ravikumar, A. C. Tangavelou, N. Dhatchanamoorthy and Noorunnisa Begum. 2018. Ethno-medico botany of Malayali tribes in Sittilingi hills, Harur taluk, Dharmapuri District, Tamil Nadu. *My Forest, Quarterly Journal of Forestry & Allied Sciences*. Vol. 54 ;(1). ISSN: 2445 – 7781. PP15-28.

N. Dhatchanamoorthy, P. Raja S. Soosairaj and M. Anbarashan. 2018. *Crotalaria prostrata* var. *levis* Haines (Leguminosae): a poorly known species rediscovered, redescribed and endemic species from the northern Western Ghats, India. *Current Botany* 9: 26-27; doi: 10.25081/cb.2018.v9.3586.

N. Dhatchanamoorthy, N. Balachandran and K. Ravikumar. 2017. Rediscovery and lectotypification of *Lepidagathis diffusa* (Acanthaceae), an endemic species from southern India. *Rheedea* Vol. 27(2); ISSN: 0971-2313.pp96–98.

K. Sambandan, N. Dhatchanamoorthy and J. Jagadeesan. 2017. On-line e-flora for Karaikal district, Puducherry, India. *Current science*, vol. 112, No. 9: 1812-1813.

P. Raja, S. Soosairaj, N. Dhatchanamoorthy and J. K. Tagore. 2017. *Derris gamblei* sp. nov. (Fabaceae) from Tamil Nadu, India. ISSN 1756-1051; Nordic Journal of Botany. Accepted Author Manuscript. doi: 10.1111/njb.01393.

1.4 Environmental Information Systems (ENVIS) Resource Partner on Medicinal Plants

ENVIS began its association at FRLHT, Bangalore in 2002, as node, was a Centre till 2016-17 and now Resource partner (RP) specialized in medicinal plants till 2017-18. This is housed in a beautifully landscaped medicinal plants garden at the host institution the Foundation for Revitalisation of Local Health Traditions (FRLHT), Bangalore and the University of Trans-Disciplinary Sciences and Technology (TDU). Today, we see ourselves as an 'e-medicinal plant information hub', that Collects, Curates and Disseminates authentic Multi-Dimensional Information on Indian Medicinal Plants to larger audience.

This RP functions chiefly due to committed ENVIS technical team members, Advisors, Centre of Excellence (COE) team mates and Host Institution (HI) team members, well-wishers. FRLHT's ENVIS RP played a main role to collate, curate and share information on medicinal plants to wider audience from 2002 to 2018.

The support enabled in creating IT enabled environment to share more than 2 decade experiences and knowledge on Indian Medicinal Plants, conservation Concern Species, Trade and related matters for diverse target groups through web applications, online versions and outreach activities. The RP constantly handles the queries related to medicinal plants research/ extension/ conservation, management, resource augmentation, policy matters, industrial guidance, cultivation etc.

As educational sources easily and freely available to public are two websites, 3 mobile apps, newsletter, and outreach activities materials including for GSDP initiatives. Hope the resources and awareness generated through this project will provide meaningful managers, researchers and wide range of audience for shaping conservation action programs.

The major highlights during 2017-18 are as follows:

Engagement in Green Skill Development Program of MOEF&CC and development of the module



Environmental Information Systems Resource Partner on Medicinal Plants

FRLHT ENVIS RP team members engaged actively with ENVIS partners to develop and launch the first of its kind 'Training module on Green Skill Development Programme (GSDP)'. This initiative was supported by Environment Information (EI) Division, MoEF&CC, Gol with Partners in Green Skilling - Zoological Survey of India, Botanical Survey of India, Salim Ali Centre for Ornithology and Natural History, Foundation for Revitalization of Local Health Traditions. FRLHT-TDU contributed all the training manuals and modules pertaining to the 'Village Botanist program' in multiple Indian languages along with other educational resource materials for implementation of GSDP by BSI-ZSI partners across the country.

1.4.1 Encyclopedia on Indian Medicinal Plants: A nomenclature browser: There are mainly dual websites on medicinal plants supported by MOEF&CC such as the popular www.envis.frlht.org and frlhtenvis.nic.in. These sites serve as a 'one-stop point' referencing resources for many of the researchers, policy makers, traders, industries, academicians, resource managers and forms part of various scientific publications. The database section is constantly updated with information on vernacular names, botanical correlations, trade, conservation concern species, geo distribution maps, scanned images of herbarium and plants, state level inventories. During 2017-2018, to the credit of FRLHT's ENVIS RP websites have reached more than **191,618,340 (1.91 crores hits in [envis.frlht.org](http://www.envis.frlht.org)) as on 31st march 2018**, which is a record breaking one in the history of our association with ENVIS India network, MOEF&CC, Gol. Alongside, 167,682 hits have been recorded from frlhtenvis.nic.in site too. This reach shows the contemporary relevance of the medicinal plants, authentic information provided on the e-resources and the meaningful contribution of ENVIS India Network (Fig.1).

1.4.2 Village sensitization Program: ENVIS RP produced online posters and shared educational resource materials on medicinal plants in Primary Health care for the Village sensitization initiative in the network.

3. Functional three mobile apps on Indian Medicinal Plants (Table 1):


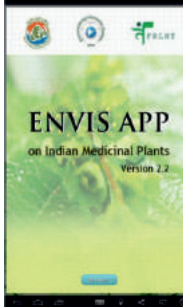

A. "Indian Medicinal Plants of Conservation Concern - Red Listed Med Plants Version 1.0": This app shares information on 335 medicinal plants of conservation concern for India. Designed especially for resource managers, policy makers, researchers, traders, manufacturers to create awareness about the threatened medicinal plants species. The contents of this app are derived from a rigorous process called Conservation Assessment and Management Prioritization process (CAMP) which adopts IUCN Red List Criteria and Categories (Version 3.1), to assign the RED List status. App can be searched through state, habit, scientific name, IUCN threatened categories. This app comprises of total 356 Red List Status species from 19 states.

Available at: <https://play.google.com/store/apps/details?id=frlht.RedlistMedplants>

B. Mobile App: Neighborhood Medicinal Plants App –Version 0.5.0 (Bangalore city) with flower colour search.

This is specially designed for students and nature lovers, who are interested to learn about their neighborhood plants that are medicinally important. This app is designed for Bangalore city. Search can be done through habit wise (Herb/shrub/tree/climbers) or through flower colour or vernacular and scientific names.

Environmental Information Systems Resource Partner on Medicinal Plants

Table 1: Different mobile apps			
<p>Indian Medicinal Plants of Conservation concern-Red List Medicinal Plants App Ver 1.1 Date December 7, 2017</p>	<p>>300 IUCN red listed medicinal plants of India https://play.google.com/store/apps/details?id=frlht.RedlistMedplants&hl=en (4 states redlisted status added)</p>	<p>Google free version (709 downloads)</p>	<ul style="list-style-type: none"> • http://frlhtenvis.nic.in/Database/Conservation_Concern_App_on_Indian_Medicinal_Plants_2600.aspx • http://frlhtenvis.nic.in/ViewGeneralLatestNews.aspx?id=2882&Year=2017 
<p>ENVIS App (2.2) Date December 14, 2015 Released by the Honorable Minister for Environment and Forest, Climate Change on 17th Feb in New Delhi</p>	<p>Detail of medicinal plants of India shared. Sharing options seen whatsapp, Gmail, Google+, etc. and window for common notification.</p>	<p>Google free version (2587 downloads)</p>	<p>Do</p> <ul style="list-style-type: none"> • http://frlhtenvis.nic.in/Database/ENVIS_APP_1935.aspx • https://play.google.com/store/apps/details?id=com.envis_frlht 
<p>Neighbourhood Medicinal Plants App 0.5.0 [with Flower Color search released in 2017]</p>	<p><i>330 Common medicinal plants of Bangalore city with flower color search</i> https://play.google.com/store/apps/details?id=frlht.neighbourhoodcity&hl=en</p>	<p>Google free version (2680 downloads)</p>	<ul style="list-style-type: none"> • http://frlhtenvis.nic.in/Database/Neighbourhood_Medicinal_Plants_Android_App_Version_0_5_0_2486.aspx 

Citizen Science initiatives: to popularize medicinal plants and traditional knowledge in Citizen science forum, yet another step was taken. ENVIS got connected to India Biodiversity Portal (<http://indiabiodiversity.org/>)

Environmental Information Systems Resource Partner on Medicinal Plants

Journal articles/ write ups

Paper: Documentation of 'Plant Drugs' dispensed via local weekly shanties of Madurai City, India.	Medicinal Plants in Trade	1 published article	<ul style="list-style-type: none"> Suma T.S., Ravikumar K., Somashekhar B. S., Ved D. K., Zaman R., Rajalakshmi S. N., Nair V. and Kukkupuni S. K. 2017. Documentation of 'Plant Drugs' dispensed via local weekly shanties of Madurai City, India. J. Ayur. Int. Med. https://www.sciencedirect.com/science/article/pii/S0975947616304478?via%3Dihub
Paper: Documentation and cataloguing of plant raw drugs traded in the selected markets of Tamil Nadu and Kerala, Southern India.	Medicinal Plants in Trade	1 published article	<ul style="list-style-type: none"> Suma T. S., Ravikumar K. and Sagar D. S. 2017. Documentation and cataloguing of plant raw drugs traded in the selected markets of Tamil Nadu and Kerala, Southern India. J. Non-Timber Forest Products 24 (4): 225-234.
Paper: Rediscovery of an endemic species, Impatiens trigonopteris Hooker f. (Balsaminaceae) from Sikkim Himalaya.	Endemic species rediscovery and Taxonomy	1 published article	<ul style="list-style-type: none"> Sumanth M.V., Ravikumar K., Dhatchanamoorthy N. and Suma T. S. 2016. Rediscovery of an endemic species, Impatiens trigonopteris Hooker f. (Balsaminaceae) from Sikkim Himalaya. Pleione 10 (2): 388 – 391 http://www.ehsst.org/journals/Pleione102/024%20Impatiens%20trigonopteris%20from%20Sikkim.pdf
Semi-technical article: Herb collectors are herb mappers.	Trade	1 published article	<ul style="list-style-type: none"> Suma TS, Ravikumar K. Herb collectors are herb mappers. MEDPLANT Newsletter, MoEF & CC, GoI and FRLHT Bengaluru.2017.

Team members involved:

ENVIS Team members:

Mr. DK Ved, Ms. Suma TS, Ms. Sugandhi Fathima, Ms. Vijay Srinivas, Mr. Vijay A Kumar, Ms. Soumyashree N, Mr. Sagar D Sangale, Mr. Naresh NK, Mr. Sumukha KV.

Advisory Committee:

Mr. D.K. Ved IFS Retd., Advisor (Medicinal Plants Expert), Professor. K. Ravikumar, Asst. Director (Expert Plant Taxonomist), Mr. Vijay Barve, Senior Program Officer (Expert GIS & Citizen sciences), Mr. P.J. Alexander, Asst. Director (Expert Administrator), Mr. B.S. Somashekhar, Asst. Director (Expert Communication)

Team support from the school of conservation of natural resources:

GIS Team: Mr. DK Ved, Dr. Vijay Barve (Senior Program Officer, Post-Doctoral Fellow, University of Florida), Ms. Sathya Sangeetha ((Assistant Professor, FRLHT-TDU); Ms. Bhagyalakshmi K. (Senior Research Fellow); **Herbarium Team :** DR. K. Ravikumar (Professor and HOD, FRLHT-TDU); Dr. Noorunissa Begum (Associate Professor, FRLHT-TDU) and team; **Garden Team:** Dr. Ganesh Babu NM, Ms. Nandini D, Ms. Revathi and team; **Additional information in NTFP page:** Dr. Arthur Selywn (Research Associate) Mr. Jaganatha Rao (Associate Professor), Ms. Deepa GB(Assistant Professor), Mr. HM Suresh(Senior Program Officer), Ms. Rajashree Mavinkurve (Assistant Professor); **Inputs manuscript:** Dr. MA Lakshmithatachar, Dr MA Alwar, Dr. MA Alwar, Sanskrit Scholar and Manuscript specialist, FRLHT, Dr. Hemanth TR

Team members of Accounts and Administration from FRLHT-TDU, Bangalore.

1.5 HD Kote Pharmacopoeia



1.5.1 Relevance

Rural communities in India are conventionally known to manage primary healthcare conditions first at the household level, and what could not be solved in the home was taken to a community based healer. If at both these levels a solution was not found, institutional help was sought from primary, secondary or tertiary healthcare services.

The first two tiers of the health system viz., the household and the community are slowly disappearing. There are many causes behind this situation. Firstly, absence of public investment in health education, targeted at households and communities. Secondly, reduced governmental support for transfer of traditional healthcare knowledge, and thirdly lack of awareness about the medicinal plants in local ecosystems.

The Institute of TransDisciplinary Health Sciences & Technology (TDU), Bengaluru in September 2014, submitted to Karnataka Jnana Ayoga (KJA), Bengaluru, a proposal entitled, ***“Develop a replicable knowledge resource for one Taluk in Karnataka (HD Kote) in the form of Geospatial Database of populations, distribution of local Medicinal Plants and a Taluk specific Herbal Pharmacopeia, on an ICT platform”***.

This proposal sought to demonstrate an innovative health security strategy, to empower households & local communities in HD Kote Taluk of Mysuru district – by inventoring, using GIS technology, medicinal plants of this taluk; to educate the households to effectively manage 30 common primary healthcare conditions and to educate students, teachers and local communities.

HD Kote Pharmacopoeia

As a pilot-project focused on one taluk– this proposal conceptualized the use of satellite imageries for locating study plots in different land use categories and landscapes for medicinal plants survey, documentation of healthcare traditions, developing GIS database and a taluk herbal pharmacopoeia, for the use of different stakeholder groups.

Considering the novelty and merit of this proposal, the government of Karnataka, approved the project for 2 years and sanctioned a grant of Rs.234.00 lakhs (copy at Annex-1) and released the first installment of grants of Rs.100.00 lakhs through the Directorate of Ayush vide letter No. HFW/227/PTD/ 2014 dated 10-02-2017.

1.5.2 Key project partners

The project has 3 key partners: 1) TDU, Bengaluru, 2) Swamy Vivekananda Youth Movement (SVYM), Saragur, Mysore, 3) Karnataka State Remote Sensing Applications Centre (KSRSAC), Govt. of Karnataka, Bengaluru.

The TDU team is responsible for designing and implementing Health Survey, Botanical studies, Pharmacopoeia development, GIS database development, Web hosting of GIS data, ToT modules and training related to Environmental Education and Health Education.

KSRSAC extends its support by providing GIS maps of 1:10000 scale which will help the TDU team to locate the study plots for vegetation and botanical studies. It will also help the TDU team to webhost the GIS data on KGIS platform.

SVYM extends its support in the design and execution of Health care survey, and ToT trainings on Environmental Education and Health education. It will also facilitate the field execution of project activities including identification of target groups, household Health Survey, Training of households in Primary Health care, Training of School Teachers, and Yearlong Environmental education activities for school students. It will also provide necessary field implementation support to TDU team.

1.5.3 Project objectives & targets

Related to Knowledge Generation

- **To conduct BASELINE SURVEY on HOUSEHOLD HEALTH STATUS in 650 households** (disease prevalence, healthcare seeking behaviour, healthcare expenditure pattern, community health knowledge and practices)
- **To develop a TALUK LEVEL PHARMACOPEIA** for Primary Healthcare conditions, based on local plant resources and traditional community health practices, revalidated by Ayurveda knowledge system.
- **To develop GIS ENABLED DATABASE** of medicinal plants of HD Kote taluk (with info on occurrence, distribution, population status and ecology of medicinal plant species, their medicinal uses, plant parts used).

1.5.4 Key activities of the project

Baseline Health Survey: A cross-sectional baseline health survey would be conducted in 650 sample households in 30 villages, to identify common illnesses and to assess the household health expenditure. Additionally, documentation of local health traditions in respect of selected 30 primary health conditions would be done by interviewing traditional healers, dais, and knowledgeable women. Rapid assessment of local health traditions (RALHT) will be followed to prioritize the traditional health practices for the purpose of promotion.

HD Kote Pharmacopoeia

Botanical Studies: Botanical and vegetation studies would be carried out to understand the diversity and population status of medicinal plants across different landscapes and habitats of HD Kote taluk. Altogether 150 plots of 0.1 ha would be laid and will be studied. Presence, distribution, abundance, regeneration and other ecological features of medicinal plants diversity will be documented. All the tree species found in these plots will be documented. Two subplots of 5m x 5m will be laid within these plots, to assess the population of shrubs and climbers; four subplots of 1m x 1m will be laid to assess the population of herbs.

Geospatial Database: An innovative application of GIS technology is envisaged for mapping the distribution of prioritized medicinal plants in the taluk. Precise locations of each sample plot will be marked using GIS technology, while the botanical data will be utilized for generating maps depicting presence and abundance of medicinal plant species. The geo-referenced database of medicinal plant resources will be uploaded on the web:

Taluk level Pharmacopoeia on Primary Healthcare Conditions: Based on the traditional healer's knowledge, local plant resources availability (obtained through botanical survey) and Ayurveda knowledge system, a taluk level pharmacopoeia will be developed. This task involves linking the field data with the corresponding information from classical texts of Ayurveda, Siddha, Unani. This linking of knowledge on resource and usage will primarily address the safety and efficacy issues, and is visualized to create awareness, promote health security and self-reliance of rural and urban households.

Training of Teachers & Students and Environmental Education activities: Approximately, 1000 students from 8th, 9th and 10th class, and 200 teachers from 50 high schools will be covered. The education modules will focus on medicinal plant identification, local biodiversity, school level GIS education. Students will be encouraged to explore the neighborhood landscapes and identify medicinal plants. Different participatory sessions will be used.

ToT Modules on Home Remedies for Primary Health and Training of Households: Training modules on local health care practices for 30 primary health conditions will be developed. Each module will focus on a health condition, its diagnosis, assessed traditional remedies with botanical resources locally available. The modules will be used to promote traditional health knowledge through continuous direct training programs to community households (200), and broadcasting the traditional health information through community radio.

End line Survey: End line survey will be conducted among 200 households, to understand the impact of household level training in respect of awareness about 30 primary health conditions (Sign, symptoms, and differential diagnosis), use of local plant resources and home remedies based on TRU (Transmission-Retention-Utilization) principles.

HD Kote Pharmacopoeia

1.5.5 Progress:

Sampling Strategy: In order to arrive at an appropriate sampling strategy, the team held a series of consultations with an expert statistician and other subject experts. The aim was to develop appropriate sampling tools so as not to miss out any variable that would have an impact on the output. The deliberations helped to freeze the focus on 650 households (being about 10% of the total no of households in the taluk) from 30 villages out of 241 villages and covering all the 5 hoblis. The variables considered include: demographic composition of villages, presence of tribal and non-tribal communities, socio-economic status of households, communities' access to civic amenities and healthcare facilities, coverage of different landscapes & land uses, wild-manmade habitats. selecting the sample villages. Sufficient care was exercised to locate the sample villages in such a way that, the selected villages are not clustered in one corner but are fairly distributed geographically in all directions and across all landscapes and would offer a representative profile of the entire taluk (Annexure-3 for the map of Sample villages and Annexure-4 for the list of sample villages)



demographic composition of villages, presence of tribal and non-tribal communities, socio-economic status of households, communities' access to civic amenities and healthcare facilities, coverage of different landscapes & land uses, wild-manmade habitats. selecting the sample villages. Sufficient care was exercised to locate the sample villages in such a way that, the selected villages are not clustered in one corner but are fairly distributed geographically in all directions and across all landscapes and would offer a representative profile of the entire taluk (Annexure-3 for the map of Sample villages and Annexure-4 for the list of sample villages)

Baseline Survey Questionnaire: The baseline health survey team in consultation with field partners and subject experts developed a Questionnaire for the survey. The questionnaire focused on eliciting information of the households in respect of their health status (disease prevalence, healthcare seeking behavior and healthcare expenditure); knowledge, attitude & practices towards home remedies for prevention & management of common health conditions. The questionnaire also attempted to gather information on the socio-economic status and other demographic details (Annexure-1). This survey tool was translated to Kannada and subsequently converted into an APP for easy documentation by the field teams.

Questionnaire for in-depth interview & focus group discussion (FGD): The team developed another questionnaire for in-depth interview & focus group discussion (FGD) with folk healers and knowledgeable individuals, in order to capture the community perspectives on traditional healthcare practices.

Household Health Survey: Subsequent to the development of baseline survey questionnaire and its conversion to APP, the field team was provided a hands-on orientation to carry out the household health survey. Subsequently, the APP was pilot tested in select households for its efficacy as the survey tool. The team monitored the pilot testing, addressed the different queries and clarifications related to field difficulties in eliciting the information. After many rounds of revision and reorientation, the household survey was carried out with full vigour and was completed by the end of March 2017. At the end of the year, the team had completed the survey in 334 households and the datasets were ready for further processing and analysis.

Development of Training module for Health education: The health survey team attempted to develop a draft prototype of the training module for health education, focused on select health conditions. This activity would be taken up during the second year.

HD Kote Pharmacopoeia

1.5.6 Progress:

The team carried out 3 botanical expeditions during the year and laid out 76 transects in 19 villages across 3 hoblis. The transects were laid out in varied landscapes and habitats including open forest, degraded scrub land, savanna, teak plantation, village pasture, abandoned fruit orchard, fallow crop field, homestead garden, tank beds, river banks and streamlines.

The diversity of plants within the plots and general floristic composition of the region was recorded. Additionally, overall regeneration of the plant species within the transects and other ecological observations were made. Altogether 583 plant species were recorded, of which 279 species are herbs, 92 trees and 113 shrubs and climbers.

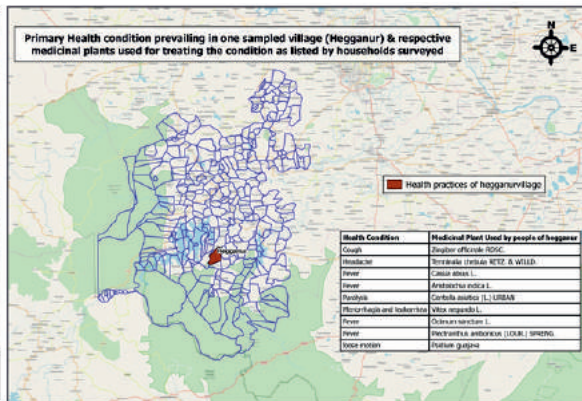
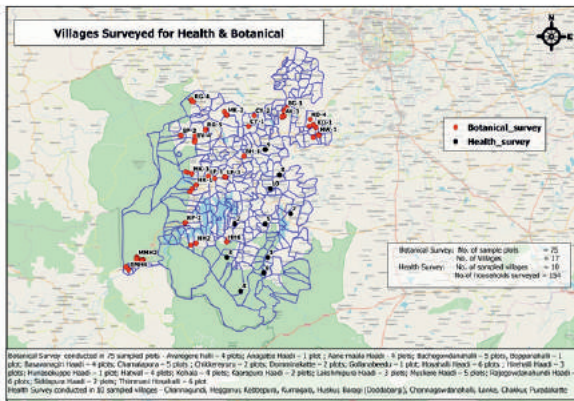
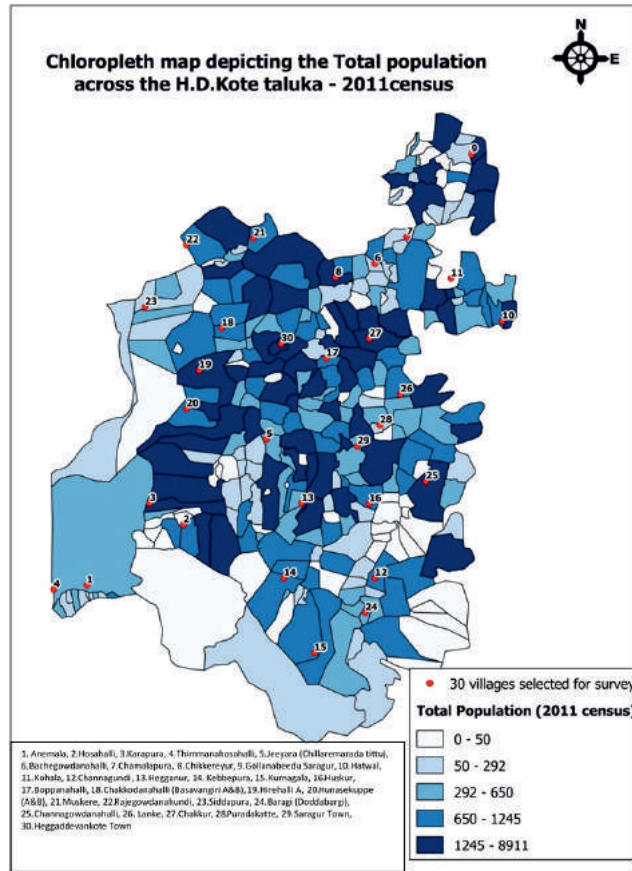
Key Ecological observations

Among the tree species, teak was the most dominant one, followed by *Terminalia crenulata*, *Anogeissus latifolia* and *Dalbergia latifolia*. It was up to 4 times more frequent than other tree species near settlements and forest plantations. However, it was noted that, regeneration of tree species was quite poor in all the sites, with the exception in respect of *Cassia fistula*, *Xylia xylocarpa*, *Dalbergia lanceolaria*, *Dalbergia latifolia*, *Terminalia bellerica*, *Vitex altissima*, *Santalum album* and *Oroxylum indicum* which showed relatively better regeneration.

It was interesting to note that many native shrub species dominated the area, as compared to non-native species, which had a significantly lower proportion and spatial distribution. However, these were quite predominant in non-forest area (village pasture, abandoned orchard, fallow field, and homestead). Among the understory species, Mimosa pudica was the most dominant, which was followed by Desmodium triflorum, Synedrella nodiflora, Cassia tora and Sida acuta. Exotic weeds especially Lantana camara was quite invasive and was present in all the sites.



HD Kote Pharmacopoeia



Progress:

Preparation of a Master list of Plants of H D Kote: A tentative master list of plants of HD Kote is used for proceeding with the development of Taluk pharmacopoeia. This list was generated based on the available published sources such as Flora of Rajiv Gandhi National Park and other published literature. These medicinal plants are tagged to different medical systems (Ayurveda, Siddha, Unani and folk) based on their medicinal usage.

HD Kote Pharmacopoeia

Medicinal plants in HD Kote in use across different systems of medicine:

Medical system	Ayurveda	Siddha	Unani	632 ASU
Ayurveda	530	380	179	
Siddha	380	480	169	
Unani	179	169	184	

The total number of plants in the project area is 994 according to the Flora of Rajiv Gandhi National Park. Out of these, 530 species are found to be in use by Ayurveda, 480 in Siddha and 184 in Unani. The total number of species used in ASU systems is 632. Out of the 530 species found in Ayurveda, 380 are also used by Siddha and 179 by Unani. Likewise, out of 480 species of Siddha, 380 are also used by Ayurveda and 169 by Unani. Similarly out of 184 species of Unani, 179 are also used by Ayurveda and 169 by Siddha.

2 Centre Ethno-veterinary Sciences and Practices

2.1 Training of trainers in Ethno-veterinary practices (EVP) veterinarians, and farmers (Ethno-veterinary Sciences and Practices)

Relevance

Widespread use of antimicrobials and other veterinary drugs in dairy animals residues in products and rising number of antimicrobial resistances. The traditional health care approaches have effective health solutions for animals. The Ethno-veterinary Program of the Trans-disciplinary University of Bangalore documented local ethno-veterinary practices (EVP) in cooperation with the Tamil Nadu Veterinary and Animal Sciences University and subsequently mainstreamed them in to the livestock primary health care through field veterinarians and farmers.

Highlights of progress/ achievements:

243 Veterinarians from 27 Milk unions of 8 states (**Andhra Pradesh, Gujarat, Karnataka, Kerala, Maharashtra, Punjab, Tamil Nadu, Telangana**) were trained to use Ethno-Veterinary Practices (EVP) for 10 clinical conditions in cattle with the support from National Dairy Development Board (NDDB). We have also trained 1150 farmers from MILMA Malabar on EVP. Identifying the preparation and dosage of ingredients formulations for various diseases.

Post Graduate Diploma in Ethno- Veterinary Practices

This programme is jointly conducted by TANUVAS and TDU only for veterinarians this is an online one year programme with 10 days contact classes for each semester. In the year 2017-2018 4 candidates have been awarded the PG Diploma

DST supported Training of small dairy farmers in Kerala, Karnataka and Tamil Nadu on ethno-veterinary practices to reduce the antibiotic residue in the milk

The Objectives of the Project

1. To conduct base-line and end-line surveys in selected location to assess the Awareness, knowledge & skill of using the Ethno-veterinary practices,
2. To estimate the expenditure on treatment of diseases in cattle using both conventional veterinary medicine & EVP
3. To find the quantity of commonly used veterinary drug (antibiotic) residue in the milk
4. To provide training to 100 farmers on ethno-veterinary practices to manage certain (5) health conditions in cattle

Highlights of progress/ achievements

10 milk unions were selected in Kerala State with the help of MILMA (P& I. of ERCUMP) Ernakulam. Eight milk unions were selected

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Table 1.Total 140 farmers from Kerala

Sl. No	Name of the society	Place	Number of farmers selected	Number of farmers selected for training	Number of farmers used as control (These farmers will not be given training)
	Kerala Ernakulam Maneed KheeraUlpadaka Society	Maneed	20	10	10
	Kerala Kottayam Monippally Kheera Ulpadaka Society	Monippally	20	10	10
	Kerala Kottayam Chakkampuzha Kheera Ulpadaka Society	chakkampuzha	20	10	10
	Kerala ErnakulanPuthrika KheeraUlpadaka Society	Putrika	20	10	10
	Kerala Ernakulan Allappara Kheera Ulpadaka Society	Allappara	15	15	0
	Kerala Ernakulan Arakkappadi Kheera Ulpadaka Society	Arakkappadi	15	15	0
	Kerala Ernakulan Manikyaman galam Kheera Ulpadaka Society	Manikyaman galam	15	15	0
	Kerala Ernakulan Sreemoolanagaram Kheera Ulpadaka Society	Sreemoolana garam	15	15	0
	Thirukanurpatti	Thanjavur	40	20	20
	Karmala	Dodbalapur	40	20	20
	Total		220	140	80

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These selected farmers from 10 milk union were trained for using EVP for more than five clinical conditions. Fifty training and 10 refreshers were conducted. All the clinical conditions treated with EVP were monitored using a feedback format. Milk samples were collected from the farmers who were trained and assessed for the presence of antibiotics Table 2

Antibiotic residue: Market sample

MILK Brand	Quinolones	Beta lactams	Tetracycline	Sulfonamides
Nandini pooled		Positive		Positive
Nandini orange		Positive		Positive
Nandini Blue		Positive		Positive
Nandini Good life		Positive		Positive
Nandini Green		Positive		Positive
Tirumala Toned milk		Positive		Positive
DODLA		Positive		Positive
Heritage Toned milk		Positive		Positive
Heritage Toned milk		Positive		Positive
MILMA Standard Green		Positive		Positive
MILMA Toned		Positive		Positive
Wayanad milk		Positive		Positive
Nilgiris milk		Positive		Positive
Swasthic milk				
Akshayakalpa		Low positive		Positive

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Baseline: Pooled sample from farmers (August-September 2017)

MILK Union	Quinolones	Beta lactams	Tetracycline	Sulfonamides
Allapara		Low Positive		
Arakkappady		Positive		Positive
Chakkampuzha		Positive	Positive	
Maneed	Positive	Positive		
Manikyamangalam		Positive		Positive
Monippally		Positive		
Puthrika	Positive	Positive		Positive
Sreemoolanagaram		Positive	Positive	
Thirukanurpatti		Positive		

Gentamicin, Streptomycin, Neomycin, Chloramphenicol: Negative

Antibiotic residue: Mid - Term evaluation (Dec. 23-27, 2017) Farmer Sample

MILK Union	Quinolones	Beta lactams	Tetracycline	Sulfonamides
Farmers Samples pooled from all unions		Positive	Positive	
Allapra		Negative		
Arakkapady		Negative		
Chakkampuzha		Negative		
Chakkampuzha 2 nd sample		Positive		
Maneed		Negative		
Manikyamangalam		Positive		
MANikyamangalam 2 nd sample		Positive		

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Akshayakalpa Toned				
Amul Taza Aluva				
MILMA ER		Positive		Positive
MILMA Pride ER		Low positive		Positive
PDDP Kalady		Positive		Positive
Jeeva Jyothi		Low Positive		Positive
Malanad A		Positive		Positive
Malanadu P				Positive
Highrange Milk				Positive
Amul Taza Pala				
Jeeva Kottayam		Positive		Positive
MILMA Kottayam				Positive

Baseline: Common Sample from the Union's collection center

MILK Union	Quinolones	Beta lactams	Tetracycline	Sulfonamides
Allapara		Positive		
Arakkappady		Positive		
Chakkampuzha		Positive	Positive	
Maneed		Positive		
Manikyamangalam		Positive		Positive
Monippally		Positive		
Puthrika		Positive		Positive
Sreemoolanagaram		Positive	Positive	
Thirukanurpatti		Positive		

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MILK Union	Quinolones	Beta lactams	Tetracycline	Sulfonamides
Monippally			Positive	
Puthrika		Positive		
Sreemoolanagaram		Positive	Positive	
Thirukanurpatti		Negative		

Antibiotic residue: Society sample (March 2017)

Society	Quinolones	Beta lactams	Sulfonamide	Remark
Sreemoolanagaram Pooled Tank		Negative		Residue Below Permissible level
Manikyamangalam Pooled Tank		Low Positive	Positive	Residue more than permissible level
Arakkapady Pooled Tank		Positive		Residue more than permissible level
Allapara Pooled tank		Positive		Residue more than permissible level
Puthrika Pooled Tank		Positive		Residue more than permissible level
Chakkampuzha Pooled		Negative		Residue more than permissible level
Maneed Pooled Tank		Positive		Residue more than permissible level
Monippally Pooled Tank		Positive		Residue more than permissible level

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Antibiotic residue: Famer's sample

Society	Quinolones	Beta lactams	Sulfonamide	Remark
Sreemoolanagaram Trained Farmers-Pooled		Negative		Residue Below Permissible level
Manikyamangalam Trained Farmers -pooled Antony Lissy Varughese		Positive Positive L Positive		Out of the 15 farmers 2 farmers used EVP + antibiotics
Arakkapady Trained Farmers-Pooled Raju Paul CV Behanan Melsi Sajan Mariamma Mathai		Positive L Positive L positive Positive Positive		Residue more than permissible level Out of 15 farmers, 4 farmers used EVP + Antibiotics
Allappara Trained farmers Pooled Komalavally NC Yacob Sabu paul		L Positive L positive L positive Positive		Out of 15 farmers, 3 farmers used EVP + Antibiotics
Maneed Trained Farmers pooled Anil Kumar Joy VU/Lizzy Joy Anni Peter		L positive L Positive L positive L positive		3 farmers used antibiotics along with Herbal medicine
Puthrika Trained Farmers pooled		Negative		Below the permissible level
Chakkampuzha Trained Farmers -pooled		Negative		Below the permissible level
Monippally Trained Farmers Pooled Babu Vadakkal Usha Bhaskaran Sumathy Mathew Sebastian		Positive Positive L Positive L Positive positive		Residue more than permissible level Four farmers used antibiotics along with EVP. Other 6 farmers milk do not contain antibiotics

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We also tested the presence of Gentamicin, Streptomycin, Neomycin, and Chloramphenicol but they were absent in all the samples

Our study shows that 104 farmers milk has found to be free of any antibiotic residue and 12 of them had low positive in Beta lactam group of antibiotics and 4 of them were positive. Quinolones, Sulfonamide and Tetracycline were completely absent in the sample collected in March 2017

Publications/Research papers/ invited talks:

1. **Nair M N B** and Punniamurthy N.2017. Contemporary Relevance of Ethnoveterinary Practices and review of Ethnoveterinary Medicinal plants of Western Ghats. In Ethno-Botany of India Vol.2: Western Ghats & west coast of Peninsular India. (eds. T Pullaiah, K.V. Krishnamurthy and Bir Bahadur. AAP, CRC Press, Taylor & Francis group. P209
2. **Nair M N B**, N Punniamurthy and S K Kumar 2017. Ethno-veterinary practices and the associated medicinal plants from 24 locations in 10 states of India RRJVS/Journal of Veterinary Sciences, Vol.3 (2),16-25.
3. **Balakrishnan Nair**, Punniamurthy N, Mekala P, Ramakrishnan N and Kumar SK.2017. Ethno-veterinary Formulation for Treatment of Bovine Mastitis, RRJVS/ Journal of Veterinary Sciences S1. 25-29.
4. Punniamurthy N, Sujatha P L, Preetha S P & N. ramakrishnan. Analysis of the mechanism of action by molecular docking studies of one ethno-veterinary herbal preparation used in bovine mastitis IJANS. ISSN(P): 2319-4014; ISSN(E): 2319-4022 Vol. 6, Issue 5, Aug – Sep 2017; 23-30
5. Punniamurthy N, Ramakrishnan N, Nair MNB, Vijayaraghavan S. In-Vitro Antimicrobial Activity of Ethnoveterinary Herbal Preparation for Mastitis. Dairy and Vet Sci J. 2017; 3(2): 555607. DOI: 10.19080/JDVS.2017.03.555607002

One day International conference on Veterinary Ayurveda conducted in West Bengal University of Animal and Fisheries Sciences (WBUAFS) on 1st Dec 2016.

Highlights of progress/ achievements

Totally 136 participants participated in the international conference 15 lead speakers, 10 oral presentations and 10 poster presentation in the conference

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Books

1. **Nair, M N B.** N. Punnyamurthy. & Kumar.S.K 2016. Ethno-veterinary treatment Guide. TDU, Bangalore (Malayalam)
2. Kumar. S.K., **M N B Nair** & N. Punnyamurthy 2016. Primary health care of animals and medicinal plants. TDU, Bangalore (Kannada)
3. Girish Kumar V. & **M N B Nair** 2016. Medicinal plants & primary health care TDU, Bangalore. ISBN:978-93-84208-02-08
4. Punnyamurthy N, **Nair M N B.** & Kumar. S.K 2016. User Guide on Ethno-veterinary Practices. TDU, Bangalore. ISBN978-93-84208-03-05

Conference

M N Balakrishnan Nair, N Punniamurthy & S K Kumar. Role of Ethno-Veterinary Practices (EVP) in reducing of antibiotic residue & Antimicrobial resistance in livestock production system: – a field experience, 63rd Annual Meeting and Congress of the Society for Medicinal Plant and Natural Product Research, Budapest, Hungary

M N Balakrishnan Nair, N Punniamurthy & S K Kumar 2016. Contemporary relevance of Ethno-veterinary Practices (EVP) and Efforts by TDU & TANUVAS in Main streaming EVP. World Ayurveda conference, Calcutta

N Punniamurthy Natesan, M Nrayanan B Nair - A decade of clinical research and applications of ethno-veterinary knowledge in India - the pragmatic way of facilitating medicinal plants to replace synthetics in animal health and production *Planta Med* 2016; 82(S 01): S1-S381 DOI: 10.1055/s-0036-1596155

3 Centre for Traditional Knowledge, Data Sciences & Informatics (CTKDS)

3.1 Nature of Main Activity:

- Deciphering, Editing, translation and publication of manuscripts on Nadi-vijnana
- Modifications to the Electronic Descriptive Catalogue of Medical Manuscripts (Under old CoE Scheme, Ministry of AYUSH, Govt. of India) .
- Preparatory work for implementation of the two projects, sponsored by Govt. of Karnataka

Brief background:

The CTKi is involved in the principal tasks of cataloguing, digitizing, deciphering and publication of the unpublished medical manuscripts. So far, FRLHT-TDU has prepared an electronic descriptive catalogue of medical manuscripts, which has 17000+ records and 5000 digitized works. Along with this, publication of unpublished medical manuscripts on dietetics and Nadivijnana is in progress. Besides, many other important works related to literary research related to the field of Ayurveda and its theoretical Foundations are being carried out.

Program/Activity description:

- 4 Unpublished medical manuscripts related to Nadivijnana identified, scrutinized, deciphered, edited and translated; print-ready version ready.
- Modifications, providing of value-additions, web-hosting of E-catalogue of Medical Manuscripts
- Preparatory works carried out to implement (from the next financial year) two major projects sponsored by Dept. of AYUSH, Govt. of Karnataka.

3.2 Development of Customized software for Cataloguing / Digitizing / editing and other tasks associated with the preservation and propagation of Medical Manuscripts (under old CoE scheme):

- Modifications have been carried out to the electronic descriptive catalogues of medical manuscripts, as per the feedback given by Ministry of AYUSH, Govt. of India. They include:
 - Corrections in the vernacular names (in local Indian languages) of medical manuscripts.
 - Correcting the number of folios varied in various records of manuscripts and so on.
- Many value-additions have been provided in the E-catalogue such as, advanced search facilities, report generation in different forms like Excel, PDF etc.
- The Electronic descriptive catalogue has also been hosted on the web portal of the TDU.

3.3 Deciphering, Editing, translation and publication of manuscripts on Nadivijnana:

- As per the MoU signed between TDU (FRLHT) and Infosys foundation, clause no. D(IV) mentions that the grant should be used for demonstration of ICT-enabled strategy for cataloguing digitization and translation of medical manuscripts, among other objectives.
- Under the above mandate, the CTKi (CTF) undertook the cataloguing, digitization and translation of medical manuscripts related to Nadivijnana. (Nadivijnna has been identified as one of the most important priority areas with regard to which medical manuscripts are to be catalogued, digitized and translated) In accordance with the above, the following is the progress achieved
 - Four unpublished manuscripts dealing with Nadivijnana have been deciphered, edited and translated.
 - The final product having the original scanned version of the manuscript, deciphered text, edited content and translation along with indexes and appendices, as been prepared and ready for publication.

3.4 Preparatory work for implementation of the two projects, sponsored by Govt. of Karnataka has been completed and work on the projects to be started from 1st of April 2018. The projects are

- Preparation and Publication of Critical Edition and Kannada & English Translations of Important Unpublished Ayurvedic Manuscripts dealing with 'Jvara' and
- Preparation of a Comprehensive Sanskrit – Kannada – English Dictionary of Ayurveda (in Print & Electronic Formats), have been carried out.

Team members

Dr. M.A. Alwar

Dr. Hemanth T.R

Vidvan M.A.Ananth

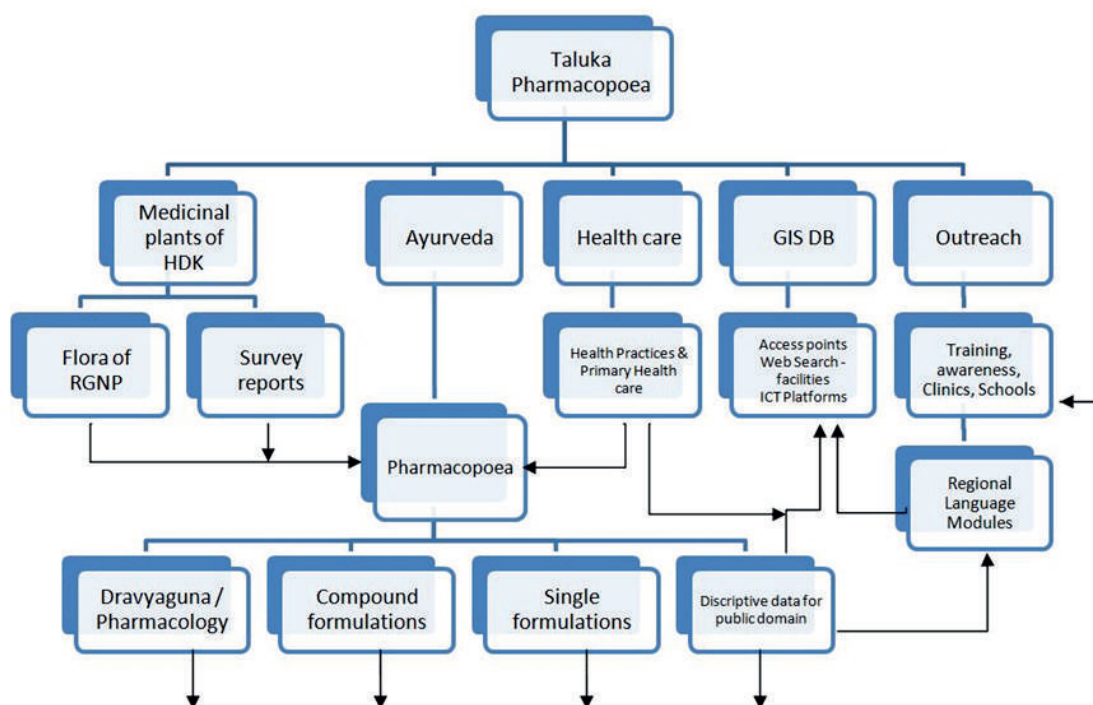
Centre for Traditional Knowledge, Data Sciences & Informatics (CTKDS)

3.5 Development of Taluka Pharmacopoea

Relevance (scientific/social) of the project:

The objective is to develop a Taluka level Pharmacopoeia for Primary Healthcare conditions, designed for healthcare providers, based on local plant resources and traditional community health practices, revalidated by Ayurveda knowledge system.

Focus of this component is to develop a Taluk level Pharmacopoeia on primary healthcare, based on local plant resources and traditional community health practices, which are revalidated by Ayurveda knowledge system. This is meant to be used by govt. agencies and individuals involved in providing healthcare. Additionally, the pharmacopoeia information can be used for training to health workers, women groups and households, for preparation of database and websites, ICT enabled educational material and APPs as envisaged in this project.



This task firstly involves linking of clinical usage information (as documented in Ayurveda) of the common medicinal plants, with the corresponding information on the availability of such medicinal plants in the taluk. Such linking of information on availability and usage will help address safety and efficacy issues of raw drugs. It is also visualized to create awareness among rural and urban households for enhancing their health security and self – reliance. Accordingly, 'Many to Many' relational schema will be developed to facilitate the linking of a particular medicinal plant in the taluk to a drug formulation (involving that particular species) and retrieval of such information in regional language using electronic media.

Centre for Traditional Knowledge, Data Sciences & Informatics (CTKDS)

3.6 Preparation of a Master list of Plants of HD Kote:

A tentative master list of plants of HD Kote is used for proceeding with the development of Taluk pharmacopoeia. This list was generated based on the available published sources such as Flora of Rajiv Gandhi National Park and other published literature. These medicinal plants are tagged to different medical systems (Ayurveda, Siddha, Unani and folk) based on their medicinal usage.

Medicinal plants in HD Kote in use across different systems of medicine

Medical system	Ayurveda	Siddha	Unani	632 ASU
Ayurveda	530	380	179	
Siddha	380	480	169	
Unani	179	169	184	

The total number of plants in the project area is 994 according to the Flora of Rajiv Gandhi National Park. Out of these, 530 species are found to be in use by Ayurveda, 480 in Siddha and 184 in Unani. The total number of species used in ASU systems is 632. Out of the 530 species found in Ayurveda, 380 are also used by Siddha and 179 by Unani. Likewise, out of 480 species of Siddha, 380 are also used by Ayurveda and 169 by Unani. Similarly out of 184 species of Unani, 179 are also used by Ayurveda and 169 by Siddha.

The team has completed Correlation of botanical names of medicinal plants to Sanskrit names pertaining to 350 species of the region. The template designed for documenting pharmacopoeia has been updated with around 3000 formulations of the plant species of the region. This has achieved Linking of plant resources to their Ayurvedic Pharmacology data from *Dravyaguna shastra* / classical texts.

Team members Involved:

Dr.S.N.Venugopalan Nair

Dr.Shilpa Naveen

Mrs.Tabassum Ishrath Fathima

3.7 Development of *In-silico* Platform for Medicinal plants based Drug discovery using Network Pharmacology & Ayurveda database to study the Complexity of Ayurvedic drug action.

Relevance

Network pharmacology is an emerging technique which integrates systems biology and computational biology to study multicomponent and multi targeted formulations. Ayurvedic formulations and multicomponent and multi targeted but their mechanism of action is not understood. The networks can illustrate and visualize the interaction of bioactive molecular targets and their relation with diseases.

This study will explain how the Ayurvedic formulations are designed and working based on different parameters. The Ayurvedic community and researchers and industries can make use of this information in their drug discovery attempts with more convincing data and analytical reports.

It is also possible to link advanced **functional genomics** or **omics** (genomics, transcriptomics, proteomics, metabolomics, phenomics) studies on disease target and pathways. This can augment *in-vitro* / *in-vivo* studies by saving the most appropriate medicine for a given condition / model and *In-silico* targets can be searched for a particular disease condition in a short period of time.

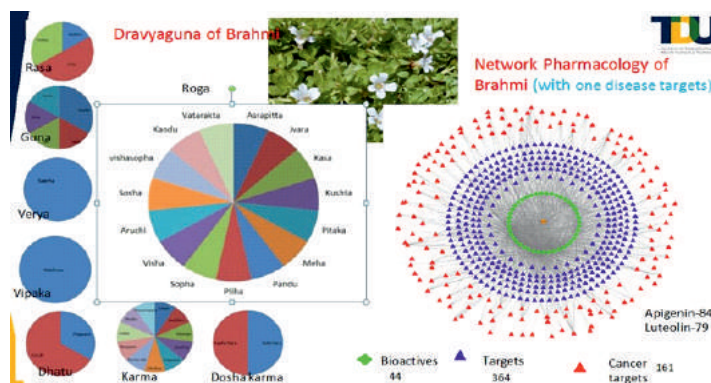
Highlights of progress/ achievements:

- A Model of the In-silico platform has been created and installed in Informatics by linking open source databases for the study.
- *In-silico* investigation of the potentials of plant *Bacopa monnieri* in cancer therapeutics has been carried out as a sample study.
- Screened 15 plants for their bioactives and targets using international databases like UNPD (Universal Natural Products Database), Dr.Duke's phyto chemical and Ethnobotanical database, This has resulted in listing out **2510 bioactives** and its targets.

The natural and traditional medicines are reemerging as promising new leads, to boost new drug discovery. Combinatorial chemistry approaches based on natural product scaffolds are being used to create screening libraries of closely resembling drug-like compounds. Normally, drug discovery follows the one gene-one target-one drug track; however, a multi-target, multi-ingredient formulation approach may be the smarter approach. It is important to address multiple targets emanating from a syndrome-related, metabolic cascade so that holistic management can be effectively achieved. Therefore, it is necessary to shift the strategy from one that focuses on a single target-new chemical entity as a drug, to one of a multiple-target, synergistic, formulation discovery approach.

Team members Involved:

Dr.Venugopalan Nair,
Mr.Nadana Vinayagan,
Dr.Vargheese,
Mrs.Tabassum,
Dr.Shilpa Naveen



3.8 Research on Medical manuscripts.

Relevance

The CTKDS is involved in the principal tasks of cataloguing, digitizing, deciphering and publication of the unpublished medical manuscripts. So far, TDU has prepared an electronic descriptive catalogue of medical manuscripts, which has 17000+ records and 5000 digitized works. Along with this, publication of unpublished medical manuscripts on dietetics and *Nadivijnana* is in progress. Besides, many other important works related to literary research related to the field of Ayurveda and its theoretical Foundations are being carried out.

3.9 Manuscript research : Deciphering, Editing, translation and publication of manuscripts on *Nadivijnana*:

The knowledge domain of *Nadivijnana* has been identified as one of the most important priority areas with regard to which medical manuscripts are to be catalogued, digitized and translated. The team undertook the cataloguing, digitization and translation of medical manuscripts related to *Nadivijnana* during the year as a part of the Infosys funded project.

Four unpublished manuscripts dealing with *Nadivijnana* have been identified, deciphered, edited and translated and the print-ready version ready.

The final product having the original scanned version of the manuscript, deciphered text, edited content and translation along with indexes and appendices, has been prepared and ready for publication.

Publication of an An E-catalogue of Medical Manuscripts

The Electronic descriptive catalogue has been hosted on the web portal of the TDU.

- Development of Customized software for Cataloguing / Digitizing / editing and other tasks associated with the preservation and propagation of Medical Manuscripts has been completed.
- Modifications have been carried out to the electronic descriptive catalogues of medical manuscripts, as per the feedback given by Ministry of AYUSH, Govt. of India. They include:
- Incorporated Corrections in the vernacular names of medical manuscripts.
- Many value-additions have been provided in the E-catalogue such as, advanced search facilities, report generation in different forms like Excel, PDF etc.

The team was also involved in the Preparation and submission of developing two proposals 1. preparation and publication of critical edition and Kannada & English translations of important unpublished Ayurvedic manuscripts dealing with 'jvara' and 2. preparation of a comprehensive Sanskrit – Kannada – English dictionary of Ayurveda.

Team members involved:

Prof.Thattachar

Dr. M.A. Alwar

Dr. Hemanth T.R

Vidvan M.A.Anantha

4 Centre for Ayurveda Biology and Holistic Nutrition

4.1 Scientific evaluation of marketed substitutes for medicinal plants facing conservation threat Relevance (scientific/social) of the project

The supply chain for medicinal plants can be made more robust, if genuine and authentic substitutes are available for the species consumed in high volumes. Systematic R&D on the bio-equivalence of *Abhava Pratinidhi Dravya* (substitutes) can establish authentic substitutes for rare, and highly demanded medicinal plants. TDU has experience in evaluating a few pairs of *Abhava Pratinidhi Dravyas*. It has used tools of pharmacognosy, phytochemistry, molecular biology and pharmacology to evaluate bioequivalence of selected substitute species. Transdisciplinary research on (rare – substitute) drug pairs.

Highlights of progress/ achievements:

In the current research program, the level of bioequivalence of the Ayurvedic formulations prepared using authentic & substitute plant parts/drugs of prioritized candidates facing conservation threat were being demonstrated using different scientific studies.

The authentic source plant for Ashoka is *Saraca asoca* (Fig. 1), which is an endangered species. Current studies show that, the Arishta prepared using the substitutes including *Shorea robusta* has estrogenic activity. Different Arishta samples showed varying degrees of estrogenic activities on cells (MCF-7 and Ishikawa) in terms of cell proliferation (Fig. 2) and Modulation in alkaline phosphates activity. The Arishta samples have also enhanced the reproductive potential of *Caenorhabditis elegans* in terms of laying eggs (Fig 3).



Figure 1: Asoka Tree

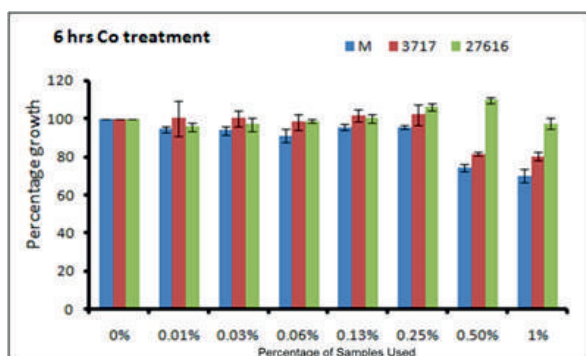


Figure 2: Effect of different samples of Asokarishta on proliferation of MCF 7 cells

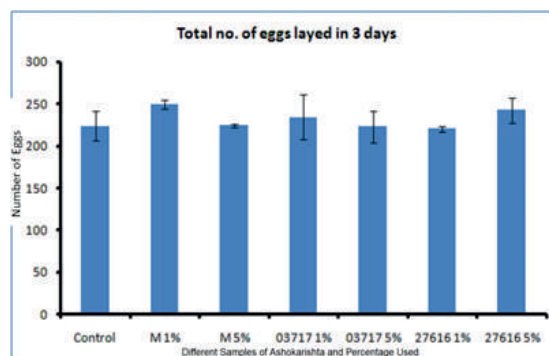


Figure 3: Effect of different samples of Asokarishta on egg laying in *C. elegans*

Centre for Ayurveda Biology and Holistic Nutrition

Embelia ribes is the authentic, but rare source for Vidanga. *Embelia tsjeriam-cottam* is a substitute for *E. ribes*. Current studies show that, Vidangarishta prepared using the substitute plant drug *E. tsjeriam-cottam* is equally potential in terms of anthelmintic activity.

Publications/Research papers/ invited talks related to the activity during the year

A poster, “*Caenorhabditis elegans* Model for Scientific Validation of Ayurvedic Formulations Enhancing Reproductive Health” was presented during the 2nd Indian *Caenorhabditis elegans* meeting held during 23-26 February, 2018 at New Delhi.

Team members involved

- a. Dr. Padma Venkat
- b. Dr. Surahmanya Kumar K
- c. Dr. Vishnuprasad
- d. Dr. Ashwini Godbole
- e. Dr. Balasubramani SP
- f. Mr. Suman Manandhar
- g. Ms. Ashwini Elango

4.2 Developing and testing of self-sustaining model(s) for the supply and use of a low-cost purification device for safe drinking water

Relevance (scientific/social) of the project:

Diarrhea continues to be a major morbidity contributor among resource poor households due to microbially contaminated drinking water. This project was aimed to productize the copper device which was developed to provide safe drinking water and to test a self-sustainable business model for the production and dissemination of the product.

Highlights of progress/ achievements:

The salient achievements of the project during March 2017- June 2018 are as below

- TamRas was successfully launched on 9th May 2017 by the Principal Secretary Health & Family Welfare, Karnataka, Dr. Shalini Rajneesh.
- Business Model: A hub-and -spoke model has been put in place in Karnataka for the manufacture, marketing, sales and distribution of TamRas.
- Training: The social entrepreneurs were trained in the importance of water sanitation and hygiene (WASH) and safe drinking water practices (SDWPs).
- Playbook: Standard Operating Procedures (SOPs) were created and a system has been put in place for the entire business operations.
- Sales: So far ~ 1000 units purchased and 750 units sold to households in the 3 study sites and 250 to other consumers.
- Royalty: FRLHT-TDU gets a royalty of 5% per piece from the manufacturer. A royalty of ~Rs. 40000 has been earned by TDU, through the sales of TamRas during the period of Oct 2017-Mar 2018
- TamRas adopter households from the 3 field sites found to have improved microbial quality (*E. coli*= 0 CFU/ 100 mL) of drinking water.
- Sustainability: Demonstrated bottom-up community based social enterprise model. However, it requires a driving mechanism, like a special purpose vehicle (SPV) in the form of a company or a trust.

Centre for Ayurveda Biology and Holistic Nutrition

Publications/Research papers/ invited talks related to the activity during the year Manuscripts for publication:

- Sheeba G, Rao S, Venkatasubramanian P. Safety evaluation of a traditional knowledge based copper device for microbial purification of drinking water at home, Indian Journal of Traditional Knowledge. 2017 July; 16 (3):519-523.
- Sheeba G, Jalagam A, Venkatasubramanian P. Drinking water contamination from peri-urban Bengaluru, India. Current Science. 2017 Nov 10;113(9)
- Anti-inflammatory effect of copper water on LPS induced cytokines in RAW cell line- Status: Manuscript under preparation
- Knowledge, Attitude and Practice of communities from three selected taluks of Karnataka in terms of drinking water and associated ailments: Status: Manuscript under preparation

Reports submitted

- 6 month physical and financial reports on the project
- 12 month physical and financial reports on the project
- Project Final Report submitted

Team members involved

Project team

FRLHT-TDU TamRas core Team

Dr. Padma Venkat (PI)

Mr. Hariramamurthi (Advisor, Social)

Dr. BN Prakash (Social, Coordinator)

Ms. Sheeba G

Dr. Sarin

Mr. Shivanand

Ms. Lali

Mr. Eswarappa

Mr. Kumaraswamy

Consultants & Research scholars

Mrs. Meetu Desai (Communication coordinator)

Mr. Venkatachari

Applied Wonder (Mr. Jayakrishnan Menon, Mr. Parag, creatives)

Yuj Designs, Pune (Mr. Prasad Bartake, Mrs. Pranali)

Mr. Prashant Mandke (Business)

Dr. PS Sundar Rao (Statistics)

Ashish, Raghini, Veda, Monica, Santhosh

Centre for Ayurveda Biology and Holistic Nutrition

Partners

Jenugoodu (of Myrada), MM Hills, Chamrajnagar district, Karnataka - Social
Samuha, Devdurga, Raichur district, Karnataka - Social
Swami Vivekananda Youth Movement, HD Kote, Mysore district, Karnataka - Social
ROONE Industries Pvt Ltd (Ravichandran, Satish Kumar), Coimbatore - Manufacturing
Selco Foundation (Huda Jaffer, Khyati, Roshan, Rachita) - Design
Sattva Consulting Pvt Ltd (Krishna, Jatin, Tulshe, Sattvika) – Business - Systems, processes capacity building
Foundation for Research in Health Systems
(Dr. Nirmala Murthi, Dr. Prakash, Mr. Gaurav for Tablet App)
BM Munjal University (Prototype development, versions)

Funding

Tata Trusts

Archana Sudhakaran (Project officer)

Mentors & Advisors

Mr. Madan Padaki, CEO Ruban Bridge, Bangalore

Mr. Manoj Kumar, CEO FISE Advisor, Tata Trusts

Mr. Sanjiv Phansalkar, Tata Trust

Dr. Nirmala Murthy, FRHS

Acknowledging the support extended by:

Dr. Balakrishna Pisupati, Former VC, TDU

Mr. Kunhikrishnan, Registrar

Mr. Suresh Hegde, Accounts Head

Mr. Alexander, Admin Head

Mr. Aju Krishnan, Accountant

Mrs. Tharini

Ms. Alphonsa Jojan



1.TamRas- concluding workshop held on 08.03.2018

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4.3 Studies on the effect of *Rasayana* therapy for diabetes mellitus - Scientific validation, chemoprospection and elucidation of functional mechanism of anti-diabetic *Rasayana* medicines prescribed in Ayurveda.

- **Relevance (scientific/social) of the project:**

The emerging trend of opting for complementary and alternate medicines for the management of life style diseases is encouraging but has limited global acceptance due to inadequate information on their mode of action, pharmacodynamics and pharmacokinetics. The research focus of the group is to understand the mode of action of Ayurvedic formulations used in the management of diabetes management.

- **Highlights of progress/ achievements:** report only noteworthy/striking elements of findings/ outputs, as bullets/ short phrases

Targeting digestive enzymes and controlling blood glucose is an important approach in diabetes management. Dietary supplements that inhibit digestive enzymes are a promising strategy for managing hyperglycemia in diabetic and borderline patients, particularly those who consume high carbohydrate diets. Ayurveda has lot to offer in this direction. The team reported a possible mode of action of a well-known Ayurvedic anti-diabetic formulation, called *Nisha-Amalaki*, prepared from turmeric (*Curcuma longa*) and amla (*Emblica officinalis*), as a potential of digestive enzyme inhibitor using *in vitro* models. Addition of honey to this formulation found to enhance the pharmacological activities, supporting the Ayurvedic basis of using honey as an adjuvant in anti-diabetic formulations. The study highlights *Nisha-Amalaki* as a potential nutraceutical dietary supplement in the management of diabetes and pre-diabetes. The team also studied an Ayurvedic formulation, Lodhrasavam, for its mode of action. The patho-physiological cross-talk between diabetes and obesity is well established, but drugs suitable for combined treatment of diabetes and obesity are limited. Ayurveda define obesity as one of the predisposing factors of diabetes and recommends specific formulations for managing obese-diabetes. Lodhrasavam is one such poly-herbal formulation prescribed for obese-diabetic patients. Lodhrasavam has shown to inhibit digestive enzymes activity as well as reduce adipogenesis (obesity marker).

- **Publications/Research papers/ invited talks** related to the activity during the year.

Butala MA, Kukkupuni SK, Padma Venkat, Vishnuprasad CN (2018). An Ayurvedic anti-diabetic formulation made from *Curcuma longa* L. and *Emblica officinalis* L. inhibits alpha-amylase, alpha-glucosidase and starch digestion, *in-vitro*. *Starch - Stärke*, 70: 1700182. doi:10.1002/star.201700182

Patra, JK, Vishnuprasad CN, Das G. (Eds.) (2017). *Microbial Biotechnology: Volume 1. Applications In Agriculture And Environment*. Springer International Publishing. ISBN: 978-981-10-6846-1. (**Edited Volume**)

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Vishnuprasad CN, Unnikannan CP (2017). Bioprospecting Traditional Medicines. Bioresources and Bioprocess in Biotechnology. Exploring potential Biomolecules, Volume-1 Status and Strategies,. Springer, pp375-395. **(Invited Chapter).**

▪ **Team members involved**

Dr. C. N. Vishnuprasad, Principle Investigator
Ms. Megha, Research Trainee

- Visits, academic activities, financial statements etc. also are a part of this annual report. Respective departments / Centres to send relevant information along with the photos. Visited Uganda as an invited partner of PHARMBIOTRAC project launch at Mbarara University of Science and Technology.

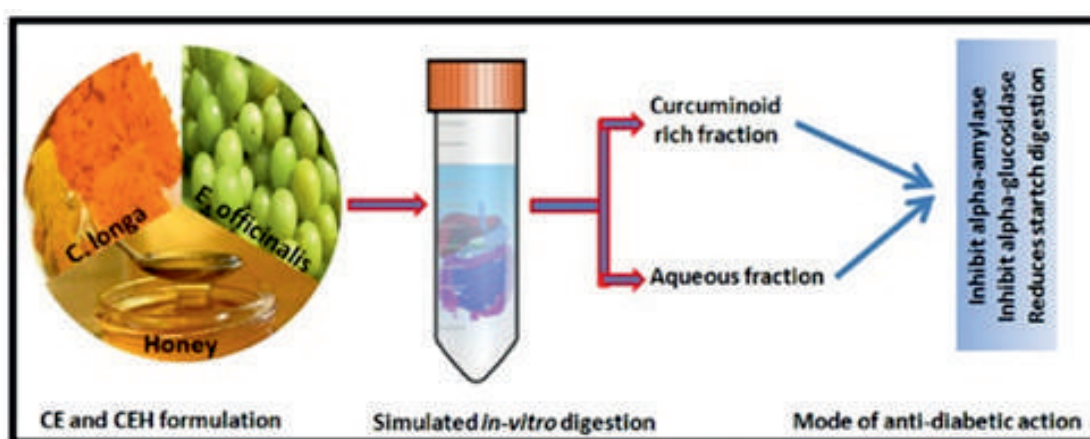


Figure 1: Diagrammatic representation of the mode of anti-diabetic action of Nishamalaki

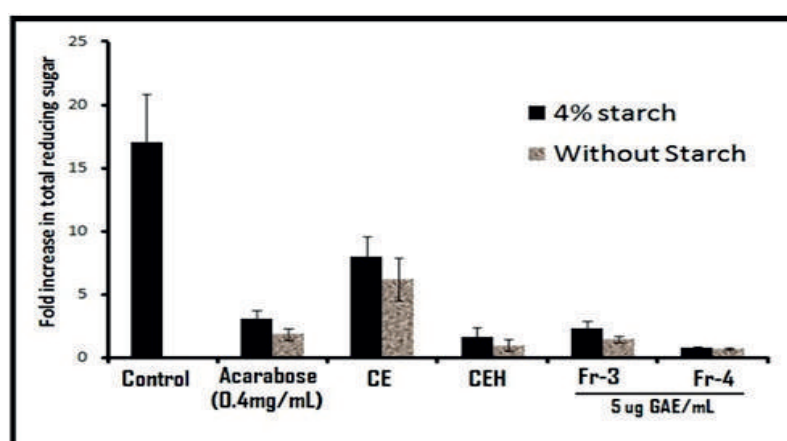


Figure 2: Nishamalaki (CE) and Nishamalaki with honey (CEH) and their active fractions reduces starch digestion: Relative fold increase in total reducing sugar after digestion

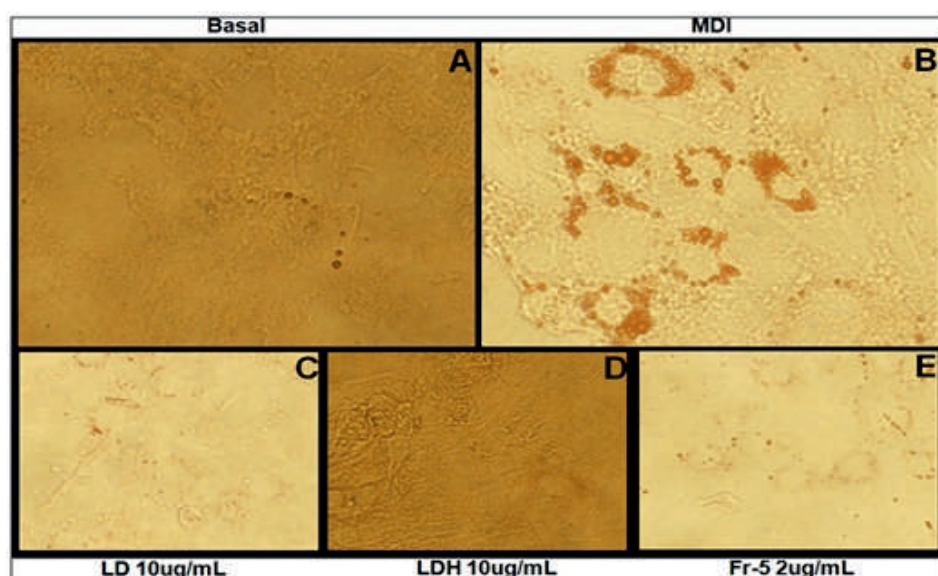


Figure 3: Effect of Lodhrasavam digest and its fractions on adipogenesis: Oil Red O staining of 3T3-L1 fibroblasts differentiated with (A) Vehicle, (B) Adipogenic cocktail-MDI, (C) MDI+Lodhrasavam digest LD, (D) MDI +LDH and (E) MDI+Fr-5 at different concentrations as indicated.

4.4 Research and Development of an Ayurvedic Fumigation Product to Improve Indoor Air Quality

▪ Relevance (scientific/social) of the project:

Fumigation is a well known method of sterilization used to eradicate harmful micro and macro-organisms in a located site. In Ayurveda, fumigation is used as one of the drug administration strategies for prevention and therapy of various diseases. Ayurveda mention fumigation as *Dhoopana* (*Dhoopa* = fumes; *Dhoopana* = fumigation) or *Dhumapana* (*Dhuma* = fume; *Dhumapana* = inhalation of fume). Fumigation research at TDU primarily intends to develop a fumigant product, based on the concepts of fumigation in Ayurveda, for enhancing the quality of indoor air. This product will be scientifically validated for its efficacy and safety using modern biological tools. Subsequently the research can be expanded to develop Ayurvedic fumigation products for the management of specific disease conditions.

▪ Highlights of progress/ achievements: report only noteworthy/striking elements of findings/ outputs, as bullets/ short phrases

Five formulations have used for the initial study. The formulations are following the Ayurvedic information available in classical texts. The formulations were named as TDUAF 1 – 5. Inhibition of the growth of *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Streptococcus pneumonia* were studied using growth curve experiment. Among the different formulations, TDUAF-1, TDUAF-2 and TDUAF-4 has shown good inhibition of bacterial growth. TDUAF-3 and TDUAF-5 did not inhibit bacterial growth in the experimental set-up. Formulations were studied for their effect on bacterial biofilm formation using *Pseudomonas aeruginosa*, *Staphylococcus aureus* and *Streptococcus pneumonia*. Biofilm formation and biofilm disruption assays were standardized. TDUAF-5 was studied for its effect on biofilm formation and biofilm disruption.

Publications/Research papers/invited talks

- Vishnuprasad CN (2016). "Microbial infections and human health: *What Ayurveda can offer?*"

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Microbial advances in Agriculture and Human Health, Apple Academic Press, Inc., (a Taylor & Francis Group), Canada. pp331-357. (Invited Chapter).

- Sarath JS, Banjai M, Sushma MS, Subramanya Kumar, Vishnuprasad CN (2018, February). Antimicrobial and Antibiofilm effects of Ayurvedic fumigation and its potential applications in drug development. Oral Presentation at the national seminar on Natural Resources for Drug Discovery and Development organized by Department of Pharmaceutical Sciences, Dibrugarh University, Assam, India

Team members involved

Dr. C. N. Vishnuprasad, Principle Investigator

Mr. Sarath J Research Fellow

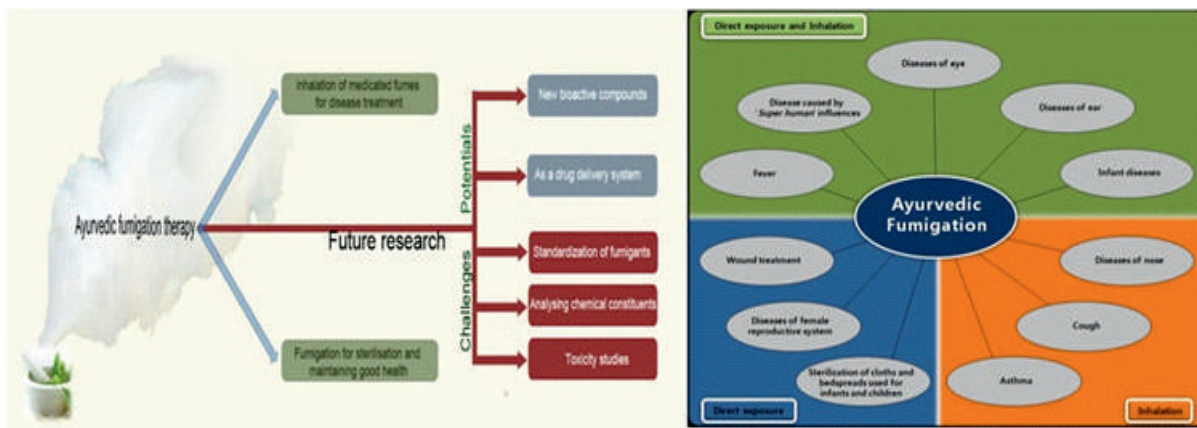


Figure 1: Schematic representation of the research on Ayurvedic fumigation and its potential applications

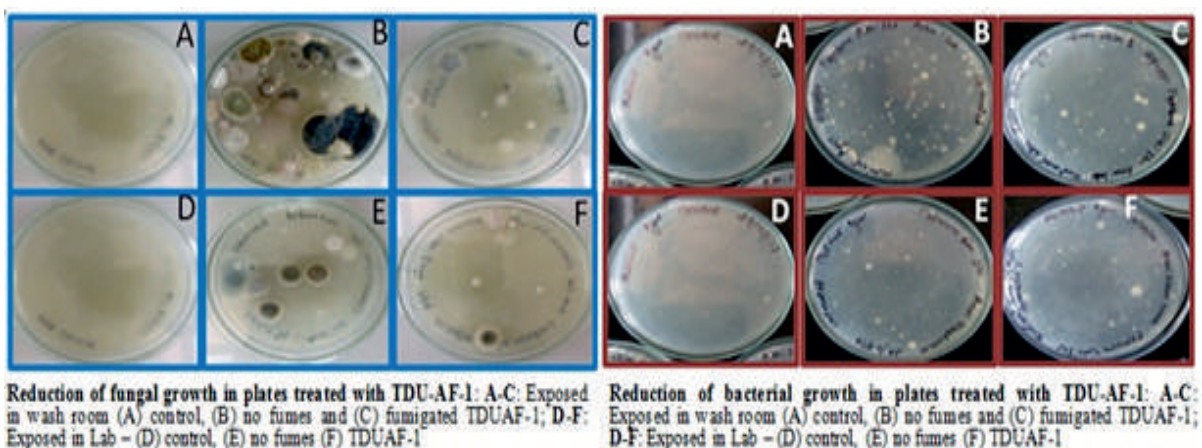


Figure 2: Reduction of fungal growth in plates treated with TDU-AF-I & Reduction of bacterial growth in plates treated with TDU-AF-I

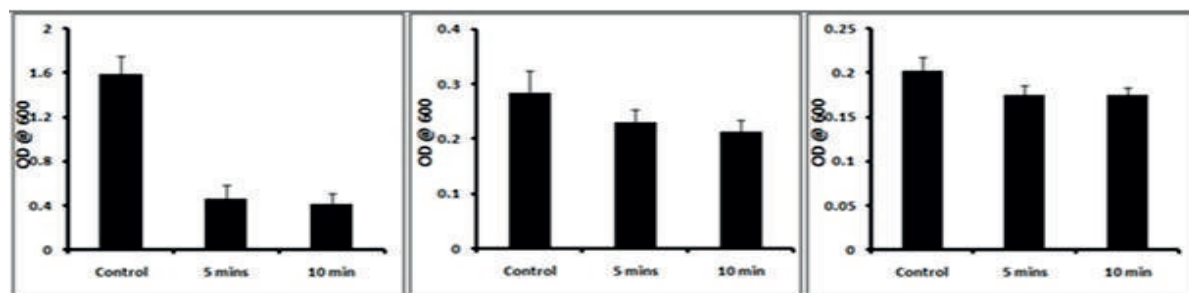


Figure 3: Effect of TDUAF-5 on Biofilm formation

4.5 Enhanced Livelihoods of Women in selected villages of Karnataka through Green Technologies Relevance (scientific/social) of the project:

The Women Technology Park, a project funded by the Department of Science and Technology aims to build capacities in women from Bangalore peri-urban villages by providing livelihood and primary health care options. The main activity of the WTP in the current project is to train women SHG members in Vermicomposting, Nursery and propagation techniques, Semi-processing, Value addition, Homestead cultivation of medicinal plants and entrepreneurial skills.

Highlights of progress/ achievements:

- We have imparted skills to 497 Women SHG members in Vermicomposting, Nursery and propagation techniques, Homestead Cultivation of medicinal plants, semi-processing & value addition and entrepreneurial skills
- 243 Women SHG members are trained in establishment of home herbal gardens for use in management of their family's primary healthcare needs
- As a result of our training programs in science and technology areas, 13 women entrepreneurs have already established vermi-composting units and selling the compost to customers and using it in their own farms
- 2 women have established medicinal plant nurseries
- Development of individual or collective entrepreneurial skills

Team members involved:

- Dr. Padma Venkat
- Dr. G.C. Mamatha
- Mr. G. Hariramamurthi
- Ms. Nandini
- Dr. Subramanya Kumar

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1. Vermicomposting hands on training at TDU



2. Vermicompost unit established by women entrepreneur

4.6 DESI-MS/ MALDI-MS tissue metabolite imaging of key medicinal plant *Dysoxylum binectariferum*: from metabolite imaging to gene discovery

1. Relevance (scientific/social) of the project: 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) syntheses 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. A new approach is urgently needed to overcome these longstanding biotechnological bottlenecks and ultimately gain sustainable production of such key medicinals. In this current program I have used the cutting edge technologies and approaches to determine cellular “phytochemical factory” location(s) of key medicinal pathway metabolites using DESI-MS/MALDI-MS tissue imaging and for identification of the remaining missing pathway genes in order to have new means for their production, including use of synthetic biology.

2. Highlights of progress/ achievements: report only noteworthy/striking elements of findings/ outputs, as bullets/ short phrases

- a. DESI MS imaging of different seed developmental stages of *D. binectariferum* was done
- b. Rohitukine accumulation increased with seed development.
- c. Rohitukine distribution was largely restricted to cotyledonary tissue.
- d. Rohitukine acetate, glycosylated rohitukine and rohitukine methoxylated are reported for the first time.
- e. Tissue specific localization of metabolites during different developmental stages of seedling growth
- f. De novo transcriptome analysis of *D. binectariferum* leaf and root samples revealed 4 partial genes could be involved in the biosynthesis of rohitukine

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Publications

- Soujanya K.N, Siva R, **Mohana Kumara P**, Amitava Srimany, Ravikanth G, Pradeep T, Thulasiram H.V, Santhoshkumar T.R and Uma Shaanker R **2018** "Isolation and characterization of camptothecin-producing endophytic bacteria from *Pyrenacantha volubilis* Hook. (Icacinaceae): Role of plasmid in the production of camptothecin" **Phytomedicine** 1;36:160-167.
- **Mohana Kumara P**, Srimany A, Arunan S, Ravikanth G, Uma Shaanker R, Pradeep T. **2016** Desorption Electrospray Ionization (DESI) Mass Spectrometric Imaging of the Distribution of Rohitukine in the Seedling of *Dysoxylum binectariferum* Hook. F. PLoS ONE 11(6): e0158099. doi:10.1371/journal.pone.0158099 **IF: 3.54**

Invited talks

- Tissue metabolite imaging: Mass spectrometry and its application in medicinal plant research, Refresher Course on Multiomic application in medicinal plant research

Team members involved: Dr. Mohana Kumara P, Amitava Srimany, Ravikanth G, Uma Shaanker R and Pradeep T

4.7 Visits, academic activities, financial statements etc. also are a part of this annual report. Respective departments / Centers to send relevant information along with the photos.

Academic activities:

- "**Indo-German Workshop on Plant-Insect Interactions Across Gradients**", November 16, 2017 to November 17, 2017, NCBS, Bengaluru-65
- One Week Workshop on "**Phytochemical analysis and isolation at TDU**" from 4th December, 2017 to 8th December, 2017.
- Two Week Academy Refresher course on "**Multiomic application in medicinal plant research**" from 19 Feb, 2018 to 3 March 2018.



Fig. 1. Reconstruction of the diversity and spatial distribution of metabolites obtained from DESI MS imaging of the different parts of seedling of *Dysoxylum binectariferum*

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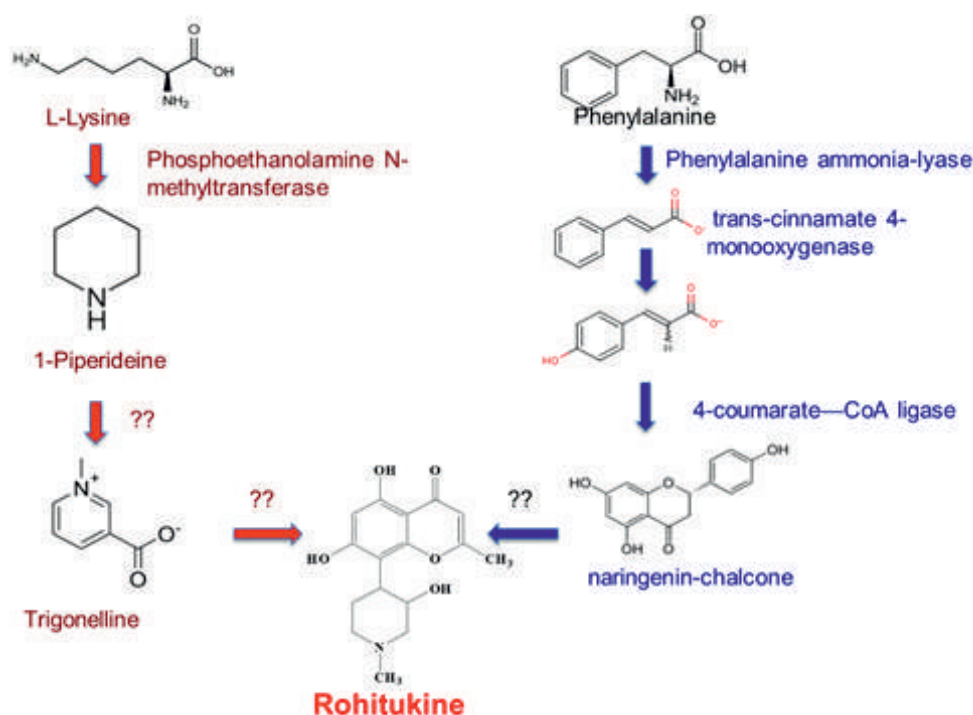


Fig. 2. Possible biosynthetic pathway of rohitukine

Understanding biological effect of Ayurvedic Nootropics

Projects:

1. Effect of different dosage forms of Brahmi on neuronal health and Disease
2. Mode of action of Ayurvedic Nootropic herbs used in treatment of PD
3. Study of mode of action of Ayurvedic Nootropic with a focus on hormones

- **Relevance (scientific/social) of the project:** Age related neurodegenerative disorders and diseases are major health concern and need urgent attention for their prevention and management. In absence of effective treatment or management strategy, scientific understanding of use of traditional Ayurvedic nootropics, such as Brahmi, Katicatchhu, Ashwagandha and Shankhapushpi, can help in tackling age related diseases like Alzheimer's and Parkinson's.
- **Highlights of progress/ achievements:** report only noteworthy/striking elements of findings/ outputs, as bullets/ short phrases
 - a. Clinically used formulations of *Sida cordifolia* (Bala), Ksheerabala and Conscora (Shankhapushpi) cold aqueous extract, inhibit A β induced paralysis in Alzheimer's disease model of *C. elegans* (Figure 1 attached)
 - b. Ayurvedic nootropics used in treatment of Parkinson's Disease show neuroprotective effect by inhibiting MPP $^{+}$ iodide induced neurodegeneration in *C. elegans*.

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Publications

- a) Invited talk titled 'Using *C. elegans* as a model for Ayurvedic Pharmacology Research' at 2nd Indian *C. elegans* meeting at NIN Delhi between 23rd-26th February 2018
- b) Poster presentations at 2nd Indian *C. elegans* meeting at NII Delhi between 23rd-26th February 2018
 - i. Vidyashankar- Differential effects of Ayurvedic formulations of *Bacopa monnieri*
 - ii. Anjaneyulu- Evaluation of mode of action of Ayurvedic nootropics in the treatment of Parkinson's Disease, using *Caenorhabditis elegans* as a model system
- c) Presented a poster in Young Investigator Meeting (YIM) 2018, organized by India Biosciences at Thiruvananthapuram between 6th-10th March 2017

Team members involved

Dr. Ashwini Godbole
 Mr. R. Vidyashankar
 Mr. Anjaneyulu Jalagam
 Dr. Varghese Thomas

Figure Legends

Fig 1: A) CL4176, a strain of *C. elegans*, shows a temperature dependent amyloid beta expression, which in turn results in a paralysis phenotype in the worm. B) *Sida cordifolia* given in the form of ksheerabala 101 and C) *Canscora decussata*, a candidate of Shankapushpi, protects the worms against amyloid beta induced paralysis.

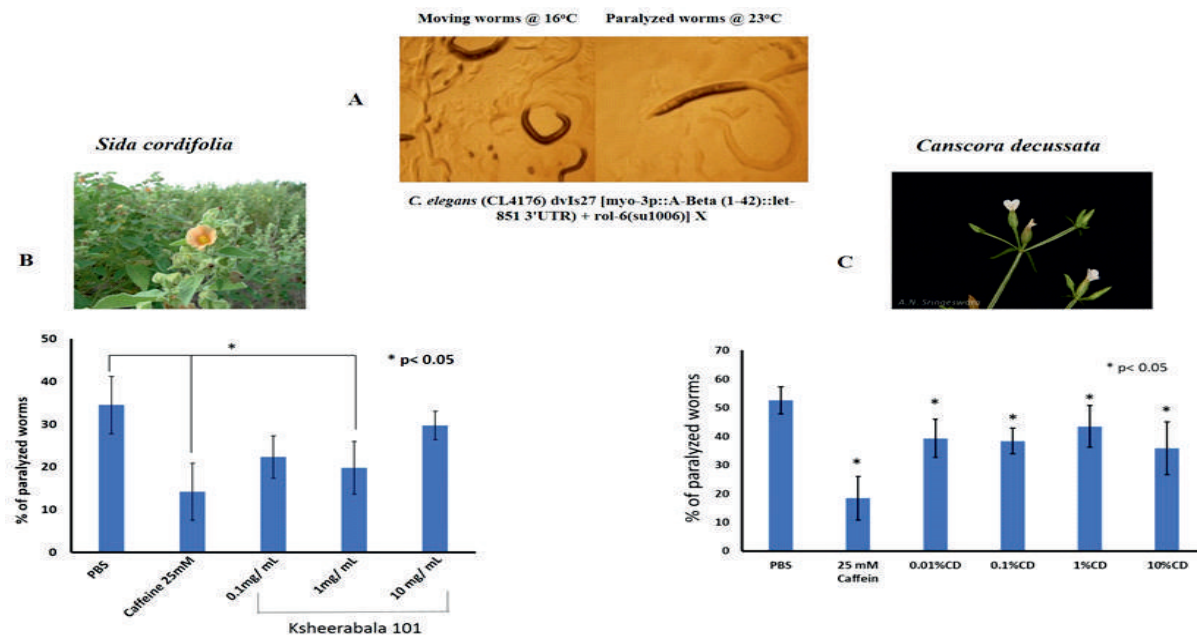


Figure: 1 Effect of Ksheerabala 101 and *Canscora decussata* on AD models of *C. elegans*

5 Center for Clinical Research and Education

Centre for clinical research at TDU is engaged in systematically evaluating clinical aspects of various Ayurvedic treatments. The on going projects are listed as below:

5.1 Project Title: Evaluation of Ayurvedic Management of uncomplicated urinary tract infections in adult females– using modern biochemical tests-A Pre-Post, Pragmatic Clinical Study

Relevance: Urinary tract infections (UTIs) are one of the most common bacterial infections and a severe public health problem affecting 150 million people each year worldwide. In modern medicine Antibiotics are drug of choice for UTI. Partially due to ineffective or inappropriate antibiotic treatment and of its resistance, UTIs leads to clinical failure and thus a major burden on most healthcare systems. Therefore, preventative approaches such as immune-modulation along with antimicrobial activity need to be encouraged more vigorously to improve clinical efficacy and to reduce resistance development pressure. Ayurvedic medicines/ herbs have shown their efficacy in preventive care/ immune-modulation/ antimicrobial activity through the clinical studies. Hence, a holistic Ayurvedic treatment could be a promising alternative of treating or reducing such infections. Thus this study is planned to evaluate the effect of Ayurveda pragmatic approach for the treatment of uncomplicated UTI.

Highlights of progress:

- Protocol was developed and was approved by Scientific Advisory Sub-Committee and Institutional Ethics Committee on February 12, 2018
- Registration of the trial with the Clinical Trials Registry India, wide registration number CTRI/2018/02/012156
- Insurance for the clinical trial obtained from Oriental Insurance Company with ref. number.
- Patient recruitment initiated on February 21, 2018

This is an ongoing project, Totally 26 patients were screened and 7 patients were recruited till April 2018.

Two studies are planned as off-shoots of this Clinical study. They are:

- The protocol for a two-arm study comparing the Allopathic and Ayurvedic management for UTI is submitted for review of sponsors.
- A biomarker discovery study taking lead from the clinical data obtained from the study participants is planned.

Team members:

Dr Neelambika

Dr Flavia Shankar

Dr Poornima Devkumar

Dr Raschel, Avineet Luthra

Dr Satish P Rao

Financial:

- a. Presently, this study is funded by Biomerieux.
- b. TDU is kept informed about the latest recruitments of subjects and other developments on a periodic basis.

Center for Clinical Research and Education

Additional Features of this Project:

- Public awareness programmes and free medical camps are being regularly conducted, with the aim of not only increase awareness regarding UTI and improve quality of life, but also to increase the participation of the local community members in this study. Please see pictures in the following sections detailing these activities.



Individual staff-driven projects: Dr. Avineet Luthra

Center for Clinical Research and Education

5.2 Project Title: Effect of Brahmi ghrita and Brahmi extract on cognitive functions in mild cognitive impairment (MCI) - a randomized controlled study.

Relevance (scientific/social) of the project: Mild Cognitive Impairment (MCI) is one of the most common clinical manifestations affecting the elderly population. It has been noticed that the risk of dementia increases by 4 to 10 times in MCI as compared to cognitively normal elderly. Although there have been various drug research studies to identify potential drugs for treatment of MCI, effective drug therapies and management are still lacking. Brahmi is important nootropic drug mentioned in Ayurveda that has been studied in extract form so far, but in this study we are trying to study the effect of classically prepared Brahmi gritha on MCI patients.

Highlights of progress/ achievements (not more than 200 words): Protocol was developed and IEC approval was obtained on 14.9.17. Data collection from cognitively healthy people has commenced. We are collaborating with ASTER CMI hospital to get the participants diagnosed as MCI patients.

Team members involved: TDU IAIM members: Dr Vivekanand, Dr Poornima Devkumar, Dr Gowripriya, Dr Ashwini Godbole. **NCBS members:** Dr. Sumantra Chattarji, Dr. Bhaktee and Dr.Lokesh Bathala (Neurologist) from ASTER CMI.

Financial: Pilot study is funded by TDU. We will write for a bigger grant once we get the data from pilot study.

5.3 The effect of Ayurvedic enema (Lekhana Basti) on Intestinal permeability in Obesity – Open labeled Prospective Single group clinical study.

Relevance (scientific/social) of the project: Obesity and associated metabolic disorders are related to impairments of the intestinal barrier. Therapeutic approaches to improve functional intestinal permeability could have a positive impact on variables of metabolic syndrome. This project was taken up to test the hypothesis that intestinal permeability in obese individuals will functionally improve after Lekhana basti (medicated enema) treatment. Lekhana Basti is indicated for obesity in Ayurveda.

Highlights of progress/ achievements: 41 overweight /obese patients were recruited, of which 31 patients met inclusion criteria, 15 gave consent for treatment, 13 were treated and two patients dropped out (did not come for third visit) due to family reasons. We thus have data for 11 patients. Significant reduction in weight, lipid parameters and inch loss was observed. Body composition analysis showed significant reduction in fat percentage and visceral fat. There was no significant reduction in HDL and Bone mass, which, however, were supposed to remain unchanged. Intestinal permeability and endotoxin results are awaited from Stellixir Biotech Pvt. Ltd Bangalore. This project is still recruiting.

Team members involved: Dr Poornima Devkumar – PI; Dr. Satish Rao – Data Analysis of Mass Spectroscopy experiments.

Financial: Budget of this project is 15 Lakhs that is funded from TDU and partial funding was from LaTrobe University Australia

Center for Clinical Research and Education

5.4 Project/program title: Evaluation of biomarkers in patients undergoing Ayurvedic Management of uncomplicated urinary tract infections in adult females

Relevance (scientific/social) of the project: This project is a systematic study to explore the suggested 'Immune-modulation' pathway of Ayurveda treatment against uncomplicated UTI. The molecular and supra-molecular changes in the bio markers in the patients receiving Ayurvedic treatment will be quantified to map the molecular pathway of recovery.

Highlights of progress/ achievements:

Detailed discussion and hence framing of the protocol done

Introduction and preliminary training to the laboratory staff regarding importance and procedure of samples handling for storage.

Team members involved

Dr. Satish Rao

Dr. Poornima

Dr. Neelambika

Dr. Rashel

Visits, academic activities, financial statements etc:

Best poster award (3rd prize) at symposium '*Traditional Health Knowledge Inspired Nutraceuticals*'.

Poster title: Prakriti as a Risk Factor for Cerebrovascular disease

Avineet Luthra, Aarthi Harini J, Rajesh KN, Sanjith Aaron and Archana Purushotham

Abstract: Case-control study to investigate whether *prakriti* is associated with risk for stroke consisting of adult subjects diagnosed with an ischaemic, haemorrhagic or venous stroke (n=166) and their caregivers/bystanders (n=159) in the hospital without a history of stroke. Stroke patients had significantly lower *kapha* scores compared to controls. There were no significant differences in *pitta* and *vata* scores. To determine if *kapha* scores added any information to a model comprising known risk factors for stroke regression analysis was performed. We found that a low *kapha* score was an independent predictor of stroke risk, in addition to known vascular risk factors (table). *Prakriti* appears to be associated with risk for stroke, and merits further epidemiological exploration.

5.5 Project Title: The effect of “*Nishakatakadi kashayam*” in drug naïve type II male diabetic patients with special focus on gut microbiome signature.

Relevance (scientific/social) of the project: Studies have demonstrated relations between gut microbiota and metabolic diseases like diabetes, obesity as the gut microbiota affect nutrient acquisition, energy harvest, and a myriad of host metabolic pathways. Diabetes treatment in Ayurveda involves improving digestion and metabolism primarily along with effect on other factors. This project was developed to investigate the effect of Ayurveda formulation *Nishakathakadi kashayam*, (which has combination of 8 drugs that act on digestion and also blood sugar levels) on gut microbiome in diabetes type 2 DM in drug naïve male cases.

Highlights of progress/ achievements (not more than 200 words): IEC approval was obtained on 8.6.17. This project is submitted to DST SERB and awaiting the results.

Team members involved: Dr Prasanna Kulkarni (PI), Dr Poornima (Co-I) from IAIM, and Dr Indranil (Co-I) Chattopadhyay Assistant Professor, Dept. of Life Sciences, Central University of Tamil Nadu, Thiruvavur, India.

Financial aspects: The budget of this project is 50 lakhs. Project proposal is submitted to DST SERB.

Center for Clinical Research and Education

5.6 Certificate course in Panchakarma Therapy & Yoga basics (sep 2017-Feb 2018)

Relevance (scientific/social) of the project: This is very important because Ayurveda, the traditional and deep rooted medicinal system of India, is now undergoing a resurgence. And one of the critical links in the service delivery of Ayurveda is *the therapist*. Therapists are trained professionals who administer medicines and various Ayurvedic therapies under the supervision of an Ayurveda Vaidya (the physician). Today, the Ayurveda sector has an acute shortage of trained therapists. The course objectives are as follows:-

- To provide skills with hands on training of all the procedures (upakarmas) related to Panchakarma therapy.
- To provide skills in Assisting physician for effective conduction of major karmas –Vamana, Virechana, Nasya, Basthi & Rakthamokshana
- To provide skills in preparations of medicines related to panchakarma and upakarmas
- To provide skills in identification & Awareness about usage of Medicinal plants in Primary health care.
- To provide knowledge of Basic principles of Ayurveda
- To provide knowledge and skills in performing yoga asanas for self health & demonstration to the patient
- To provide skills of Patient care, basic nursing skills and first aid services at Hospital
- To provide Soft skill and communication skills
- To provide Awareness to Adopt good hygienic standards, etiquette and values

Highlights of progress/ achievements:

- 15 students trained (13 from Karnataka, 1 from Tamil nadu & 1 from Assam).
- Campus interview was conducted. All the 15 students have got job (100% placement).

Team members involved

- IAIM health care, Bangalore
- Swamy Vivekanada Youth Movement, Sargur, HD kote
- Vivenkanada Memorial Hospital, Sargur, HD kote
- Shatayu Ayu Pvt. Ltd., Bangalore
- Vivekananda Health global, Bangalore

Financial:

- The program is self financed by the fee paid by the students.

Center for Clinical Research and Education



To train 25 students in Panchakarma therapy & Yoga basics; Project submitted to BOSCH under CSR grants

5.7 : 5-days workshop on “Ayurveda Dinacharya” an Ayurvedic Advice on Daily regime practice (18th to 22nd December 2017)

Relevance (scientific/social) of the project: Diet & lifestyle customized for each individual is the first and foremost key for good health. Ayurveda has a set of guidelines of certain health practices that can be incorporating in daily lifestyle which has definite impact towards promotion of health & also prevents expected ailments. The workshop has following objectives:-

- To provide awareness about Ayurveda & knowledge on Principles of “Ayurvedic advice on Daily routine/regime”
- To provide skills in practicing the Ayurvedic Advice in Daily regime
- To provide Skills in preparing the items, for effective practice of Daily regime

Highlights of progress/ achievements (not more than 200 words):

- 14 participants from Malaysia & Singapore participated in the workshop.

Team members involved

IAIM health care, Bangalore

Veg school, Malaysia (Coordinator – Wong Kee Yew)

Financial:

- The program is self financed by the fee paid by the students.

Center for Clinical Research and Education

5.8 : 2 days short workshop on “Ayurveda Dinacharya” an Ayurvedic Advice on Daily regime practice (15th Feb 2018 to 16th Feb 2018)

Relevance (scientific/social) of the project: (not more than 50 words): Ayurveda and Yoga share common philosophical background. Even practice wise both complements each other. This program is an attempt to integrate Ayurveda with Yoga. Swami Mahesh, who is an Yoga teacher from Bihar School of Yoga conducts one month Yoga teachers training program for Indian & Abroad students. The objective of the program is as follows:-

- To provide awareness about Ayurveda & knowledge on Principles of “Ayurvedic advice on Daily routine/regime”
- To provide skills in practicing the Ayurvedic Advice in Daily regime

Highlights of progress/ achievements (not more than 200 words):

8 participants from Europe & US participated in the workshop

Team members involved

IAIM health care, Bangalore

Swami Mahesh, Bihar school of Yoga

Financial:

The program is self financed by the fee paid by the students.

5.9 One day orientation program for Srilankan Ayurveda doctors (29th August 2017)

Relevance (scientific/social) of the project: (not more than 50 words): IAIM health care centre being the Centre for Excellence for Ayurveda practice, demonstrates the higher quality in Infrastructure & Clinical practice. This facilitates scholars & peers of Ayurveda to visit & interact with the expert team. The broad objective of this program is listed as follows:-

- To explore & educate Srilankhan Ayurveda doctors on modern Ayurvedic techniques that are used today to treat patients

Highlights of progress/ achievements

- 42 Srilankhan Ayurveda doctors participated

Financial:

- This program doesn't attract any fee component. As is it executed as only exposure visit. Logistical expenses are paid by the participants.

Center for Clinical Research and Education

5.10 Foundation Training Programme for Newly Recruited CHS Medical Officers' (One week - 22nd to 27th May 2017)

Relevance (scientific/social) of the project: (not more than 50 words): The National Institute of Health and Family Welfare (NIHFW) had deputed medical officers to IAIM-TDU with an objective of exposure to AYUSH systems of medicines, so that the medical doctors are aware of the scope & limitations of each other system of medicine.

Highlights of progress/ achievements (not more than 200 words):

09 Allopathic doctors/ medical officers attended the Foundation training program. These medical officers are newly recruited under MoH&FW and will be working at various levels of Clinical & Administrative positions helping mainstreaming AYUSH programs in NHM.

Financial:

This program was sponsored by National Institute of Health and Family Welfare (NIHFW) on actual expenses of the program.

Project proposals in pipe line & progress

1. Training 500 rural youths of Odisha in skills of Panchakarma Therapy & Yoga Basics in 5 years. (2018-2023).
 - The project is submitted to Skill development Authority, Odisha.
 - Status as on 31st march 2018 - The project approval meeting cum presentation is scheduled in April second week.
2. One pilot batch of Training 25 unemployed youth in skills of Panchakarma Therapy & Yoga Basics in 5 years. (2018-19).
 - The project is submitted to BOSCH India Foundation under CSR grants
 - Status as on 31st march 2018 - The project is accepted and sent to finance committee for approval
3. To develop research protocol for the studying 'Influence of Ayurveda education with diet & lifestyle modifications in Non-Indian origin participants visiting IAIM for Ayurveda Educational programs and staying for more than One week'
4. To develop research protocol for the studying 'Effect of Panchakarma treatment procedures on Patients /people undergoing various Panchakarma procedures for wellness & treatment of disease at IAIM'

6 Center for Functional Genomics & Bio-informatics

6.1 Integrated genomics-assisted breeding for efficient development of superior finger millet varieties for Karnataka

1. Relevance (scientific/social) of the project: Ragi (Finger millet) is one of the neglected and underutilized cereal crops. In India, Karnataka constitutes largest area over 0.72 million ha contributing over 70% of total production during year 2013-14 (provisional estimates of Agriculture Department, Government of India) and is predominantly consumed as a staple food grain. The grain is already nutritious, but can be further improved into a nutritious "super cereal" that alleviates malnutrition, especially in women and preschool children.

2. Highlights of progress/ achievements

- A set of varieties released in Karnataka state (33 Varieties) along with other superior cultivars and advanced breeding lines which can be dated back to early 1900 to till recently developed varieties (2017) was constituted for genome re-sequencing.
- A set of 53 cultivars (BLAST resistant and Susceptible) with diverse blast reaction was also selected for re-sequencing by using the state of the art Next Generation DNA Sequencing (NGS).
- Seeds of finger millet that are described above are grown in open field and green house at University of Agricultural Sciences, GKVK, Bangalore, India (Figure 1 & 2).
- Freshly grown leaves were used for the extraction of high molecular weight DNA for the NGS based genome sequencing.
- Initially the team faced a challenge for obtaining the high molecular weight DNA but this challenge was overcome by constant focus and diligent troubleshooting to obtain a superior and higher molecular weight DNA from 45 finger millet leaf tissues and NGS was initiated at Center for Cellular and Molecular Platforms (C-CAMP), NCBS, Bangalore.

3. Publications/Research papers/ invited talks: Nil

Team members involved

- Dr Malali Gowda,
- Dr Santosh P,
- Dr Venu Seenappa,
- Ms Ashalatha KL

4. Visits, academic activities and financial statements

Regular field experiments and project reviews (23rd June 2017, 14th November 2017, December 26th 2017, 6th January 2018, and 2nd February 2018) were held at the small millet scheme unit, University of Agricultural Sciences, GKVK, Bangalore, India (Figure 3).

Center for Functional Genomics & Bio-informatics

Financial statement for Integrated genomics-assisted breeding for efficient development of superior finger millet varieties for Karnataka objectives from June 2017

Sl.No.	Heads	Expenditure(INR)	Released Funds to TDU
1	Man power	6,90,000	
2	Automated NGS library Prep Instrument/Equipment	15,00,000	
3	Re-sequencing of germplasm accessions and improved cultivars including accessions from Karnataka state (34 lines)	14,75,685	
	Total (Rs)	36,65,685	36,64,000



Figure 1: Raising of Finger millet seedlings in Green House.



Figure 2: Finger millet seedlings sown in open field on 10th September 2017.

A)



B)



Figure3: Images taken during Finger millet project meetings

a) Ragi Genome Meeting at Millets Scheme, GKV, held on 14th November 2017.

b) Ragi Genome Meeting at Millets Scheme, GKV, held on 2nd February 2018.

(We also held meeting on 23rd June 2017, December 26th 2017 and 6th January 2018 at GKV)

Center for Functional Genomics & Bio-informatics

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

Relevance (scientific/social) of the project:

Pistacia integerrima belongs to family *Anacardiaceae* widely distributed in North-West and Western Himalayas and called by different names such as kakroi, kakarsinghi and kakarsinghi. *Pistacia chinensis* subsp. *Integerrima* is well-known for formation of galls on leaves and petioles. These galls are horn shaped, formed due to insect attack of *Pemphigus species*. Need for this study was felt because of the high demand (estimated annual trade: 200-500MT., increased during past two decades), but fluctuation and constant decrease in the supply of Karkatashringi. Till date, no studies were taken up on production of galls, interaction of plant & insect as well as bottleneck in gall production.

Highlights of progress/ achievements:

- Identification of gall related genes from the study
- Identification of differentially expressed genes in gall and leaf
- Identification of genes specific to different stages of gall
- List of annotated Highly Expressed Genes in Gall
- List of annotated Differentially expressed genes Upregulated in Leaf
- The cascade of events that leads to gall formation
- Comparative metabolic process in Gall and Leaf
- Identification of Proteins from the cottony material of dry gall - Tentatively found as polymer protein
- Phylogenetic analyses of *Pistacia integerrima*

Publications/Research papers/ invited talks related to the activity during the year.

Poster presentations on “De novo Sequencing of transcriptome of *Karkatashringi* (*Pistacia integerrima*) Galls” at National Symposium on Future of Functional Genomics (TransDisciplinary Genomics–I) conducted on October 13-14, 2017 at TransDisciplinary University, Bengaluru.

Team members involved

Dr. Malali Gowda
Dr. Pavithra N
Dr. Noorunnisa Begum

Center for Functional Genomics & Bio-informatics

6.3 Visits, academic activities, financial statements etc. also are a part of this annual report.

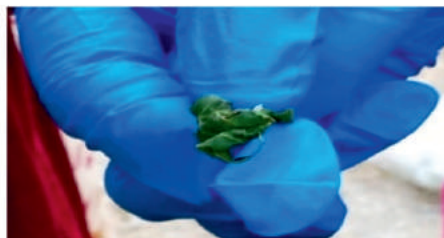
Attended 3 days "Workshop on Fundamentals of Mass Spectrometry-based Metabolomics" on September 18-20, 2017 at Centre for Systems Biology and Molecular Medicine (CSBMM), Yenepoya Research Centre, Yenepoya University, Mangalore.



**Plant Sample
Collection**



Gall (Stage 1)



Gall (Stage 2)



Matured gall (Stage 3)



Leaf (Control)



Figure 1: Sample collection from Uttarkhand

Figure 2: Field work at Uttarkhand

Center for Functional Genomics & Bio-informatics

6.4 DESI-MS/ MALDI-MS tissue metabolite imaging of key medicinal plant *Dysoxylum binectariferum*: from metabolite imaging to gene discovery

Relevance (scientific/social) of the project: 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) syntheses 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. A new approach is urgently needed to overcome these longstanding biotechnological bottlenecks and ultimately gain sustainable production of such key medicinals. In this current program I have used the cutting edge technologies and approaches to determine cellular “phytochemical factory” location(s) of key medicinal pathway metabolites using DESI-MS/MALDI-MS tissue imaging and for identification of the remaining missing pathway genes in order to have new means for their production, including use of synthetic biology.

Highlights of progress/ achievements: report only noteworthy/striking elements of findings/ outputs, as bullets/ short phrases

- a. DESI MS imaging of different seed developmental stages of *D. binectariferum* was done
- b. Rohitukine accumulation increased with seed development.
- c. Rohitukine distribution was largely restricted to cotyledonary tissue.
- d. Rohitukine acetate, glycosylated rohitukine and rohitukine methoxylated are reported for the first time.
- e. Tissue specific localization of metabolites during different developmental stages of seedling growth
- f. *De novo* transcriptome analysis of *D. binectariferum* leaf and root samples revealed 4 partial genes could be involved in the biosynthesis of rohitukine

Publications/Research papers/ invited talks related to the activity during the year.

Publications/Research papers

- Soujanya K.N, Siva R, Mohana Kumara P, Amitava Srimany, Ravikanth G, Pradeep T, Thulasiram H.V, Santhoshkumar T.R and Uma Shaanker R **2018** “Isolation and characterization of camptothecin-producing endophytic bacteria from *Pyrenacantha volubilis* Hook. (Icacaceae): Role of plasmid in the production of camptothecin” *Phytomedicine* 1;36:160-167.
- **Mohana Kumara P**, Srimany A, Arunan S, Ravikanth G, Uma Shaanker R, Pradeep T. **2016** Desorption Electrospray Ionization (DESI) Mass Spectrometric Imaging of the Distribution of Rohitukine in the Seedling of *Dysoxylum binectariferum* Hook. F. *PLoS ONE* 11(6): e0158099. doi:10.1371/journal.pone.0158099 IF: 3.54

Invited talks

- Tissue metabolite imaging: Mass spectrometry and its application in medicinal plant research, Refresher Course on Multiomic application in medicinal plant research

Team members involved:

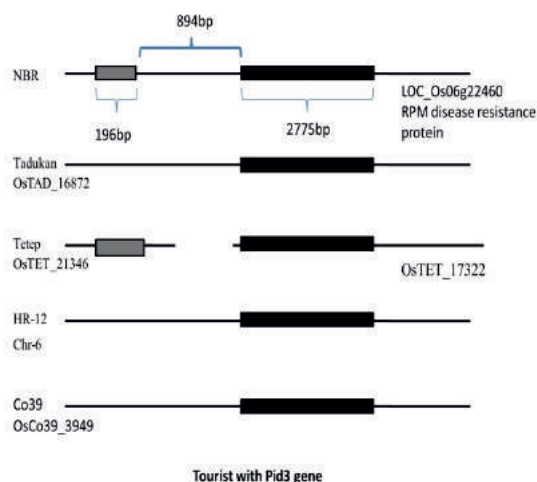
Dr. Mohana Kumara P, Amitava Srimany, Ravikanth G, Uma Shaanker R and Pradeep T

Center for Functional Genomics & Bio-informatics

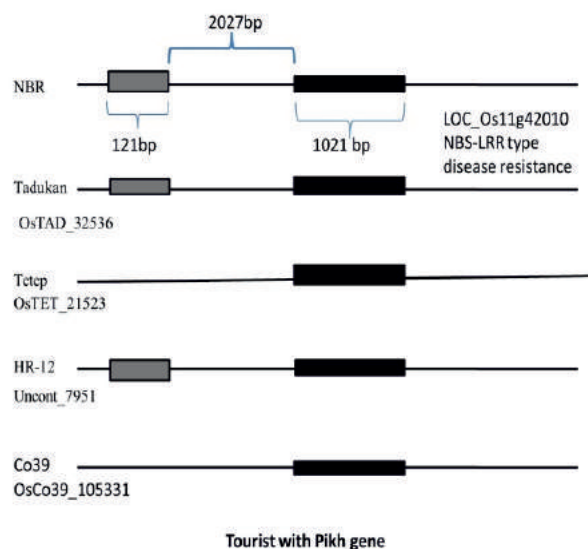
6.5 Visits, academic activities, financial statements etc. also are a part of this annual report. Respective departments / Centers to send relevant information along with the photos.

Academic activities:

- **“Indo-German Workshop on Plant-Insect Interactions Across Gradients”**, November 16, 2017 to November 17, 2017, NCBS, Bengaluru-65
- One Week Workshop on **“Phytochemical analysis and isolation at TDU”** from 4th December, 2017 to 8th December, 2017.
- Two Week Academy Refresher course on **“Multiomic application in medicinal plant research”** from 19 Feb, 2018 to 3 March 2018.



Association of Tourist MITE and *Pid3* R-gene in different rice varieties (Nipponbare (NBR), Tadukan, Tetep, HR12 and Co39). The grey and dark black boxes are indicating Tourist MITE and *Pid3* R-gene respectively.



Association of Tourist MITE and *Pikh* R-gene in different rice varieties (Nipponbare (NBR), Tadukan, Tetep, HR12 and Co39). The grey and dark black boxes are indicating Tourist MITE and *Pikh* R-gene respectively.

Center for Functional Genomics & Bio-informatics

6.6 Microbiome study of underground parts of *Crocus sativus*

Plant microbiomes are critical to host adaptation and impact plant productivity and health. Plant Growth-Promoting Rhizobacteria (PGPR) display several plant-beneficial properties, suggesting that the accumulation of the corresponding genes could have been selected in these bacteria (Ofek-Lalzar et al., 2014). Next generation sequencing technologies have revolutionized the study of complex microbial communities (microbiomes). Root-associated microbiomes vary by soil, geographical location and host genotype in many plants, but no such studies has been done in *Crocus sativus* till date. *Crocus sativus*, commonly known as Saffron, is the world's costliest spice with medicinal value and one kilogram costs around 11,000 US \$ (Melnyk et al., 2010 Wani et al 2011). It is a sterile triploid plant ($3n= 24$) and reproduces vegetatively by underground bulb-like, starch-storing organs known as, corms. (Nehvi and Salvee 2010). In the present study, the rhizosphere samples was collected during the flowering stage (November 2016) from two different fields varying in their production as well as geographical location.

Highlights of progress/ achievements:

- A total of 10 saffron rhizosphere samples were collected at flowering stage (Oct-Nov 2016, 2017)
- High molecular weight DNA was extracted from all the samples and 16S rRNA amplicon library was prepared using Illumina and Nanopore library preparation protocols.
- The microbiome of saffron rhizosphere was sequenced using two different sequencing technologies, Illumina and Nanopore.
- Data QC using bioinformatics fastqc tool kit
- Microbiome analysis of Illumina data using pipelines like MGRAST, QIIME
- Microbiome analysis of Nanopore data using pipelines like MGRAST, QIIME, EPI2ME
- Identified taxonomy upto species level using Nanopore sequencing taxonomy
- Generated plots for microbiome analysis, rarefaction, heatmap, PCOA plots and taxonomy plots
- Standardised the microbiome analysis pipeline using standalone BLASTn fusing greengenes database.
- Submission of yearly annual progress report, statement of expediture and utilisation certificate.

Publications/Research papers/ invited talks related to the activity during the year.

- Ambardar S and Gowda M (2017) High resolution full-length HLA typing method using third generation (Pac-Bio SMRT) sequencing technology; In Editor/Sebastian Boegel HLA Typing: Methods and Protocols. Methods in molecular biology, Springer (In press)
- Poster submission to NPDP-SERB for midterm evaluation.

Team members involved

- Dr. Malali Gowda
- Dr. Sheetal Ambardar



Sample collection from Kashmir and Kistwar, Jammu and Kashmir.

Growing one of the Saffron sample in Bengaluru.

Center for Functional Genomics & Bio-informatics

6.7 “genome-wide analysis of mine retrotransposon across the magnaporthe rice and non-rice isolates “

1. Relevance (scientific/social) of the project:

Blast disease is caused by Ascomycetes fungal pathogen *Magnaporthe*, which is severely effect on important food crops such as rice, finger millet, foxtail millet, wheat, barley, oat and various grass species. The 9.8% of the *Magnaporthe* genome is made up of transposable elements which are capable of duplicating themselves and also causes mutation. In such one of the retrotransposon is MINE (Mixed Interspersed Nuclear Element) is a chimeric element which belongs to the LINE (Long interspersed nuclear element) superfamily.

2. Highlights of progress/ achievements:

- In this study, there were 26 genes of *Magnaporthe* composed of MINE element itself, which were not considered for further analysis. The rest, 22 genes associated with MINE were selected for genome-wide comparison between rice and non-rice isolates, which found to have unique MINE element.
- The 22 types of various repetitive sequences of MINE footprints were found. The identified unique MINE footprints were named as AIM (Associated interaction of MINE).
- The maximum number of copies of MINE footprints mapped on *Magnaporthe* gene was part of the MGL region of MINE element and minimum number of copies that were part of the WEIRD region.
- In most of the these genes, MINE signatures/footprints dound be associated with exonic (42 genes), intronic (25 genes), 3' UTR (22 genes), 5' UTR (5 genes).

3. Publications/Research papers/ invited talks :

Poster presentation on topic entitled “Genome-wide Analysis of Transposons in rice field isolates of *Magnaporthe*” National Symposium on Future of Functional Genomics, TDU, Bengaluru-560064.

Team members involved

Dr Malali Gowda

Ms. Ashalatha KL

7 Institute of Ayurveda and Integrative Medicine Hospital

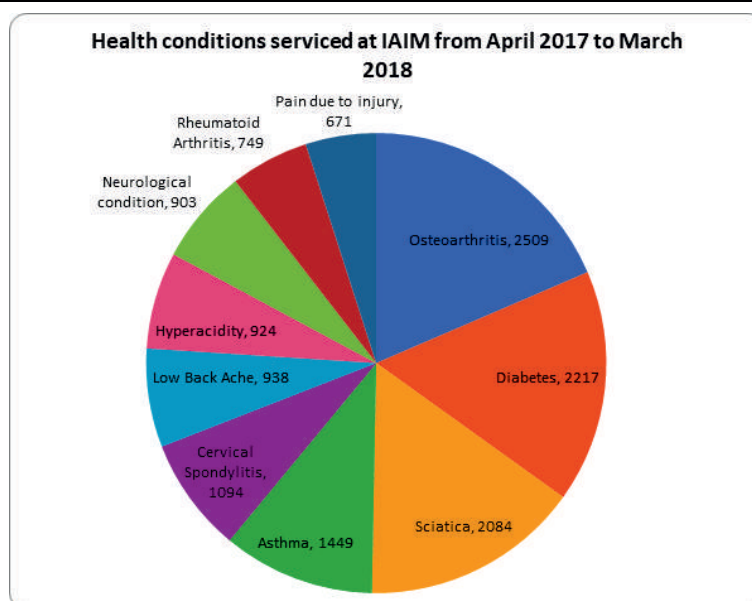
IAIM Health Care Centre is a 100 bedded hospital with modern diagnostics facilities. IAIM Health Care Centre is a specialized medical research and health services unit of TDU. It provides authentic Yogic and Ayurvedic treatments, in a very calm and serene atmosphere, away from the hustle and bustle of the city life under the able guidance of knowledgeable physicians and yoga experts. The IAIM is located in the TDU campus which is uniquely landscaped with over 950 species of medicinal plants.

7.1 CSR Funding : Period 1st Apr 2017 – 31st Mar 2018

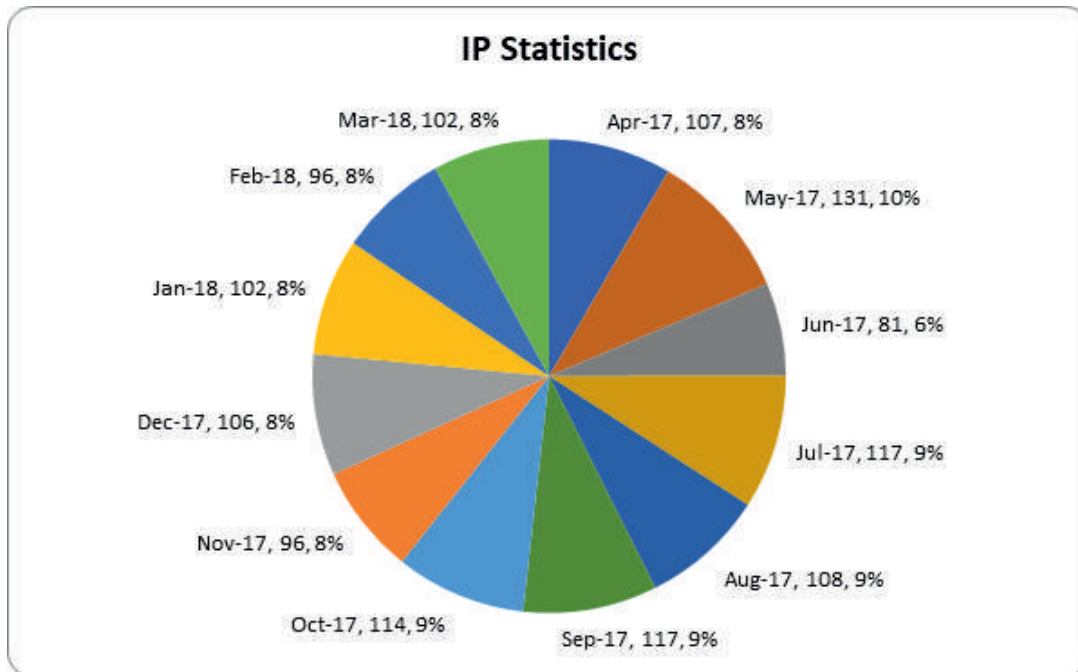
Name of Donor	Purpose & Utilisation	Amount
Menzies Aviation Bobba Pvt LTD, Bangalore	CSR Funding: For providing Healthcare services for Poor patient and to provide high subsidy to patient who come at IAIM for their healthcare management.	Rs.25,00,000/-
THE HANS FOUNDATION, New Delhi	Making an Eco-Friendly Hospital Campus: Donation received for installation of 85KWA Solar Rooftop Panels for the Hospital campus, which will save almost 50% of the total electricity consumption.	Rs.75,00,000/-
THE HANS FOUNDATION, New Delhi	Support for Poor Patients: Donation received for giving free/highly subsidise treatment for economically weaker section patients.	Rs.48,00,000/-

7.2 Health Services

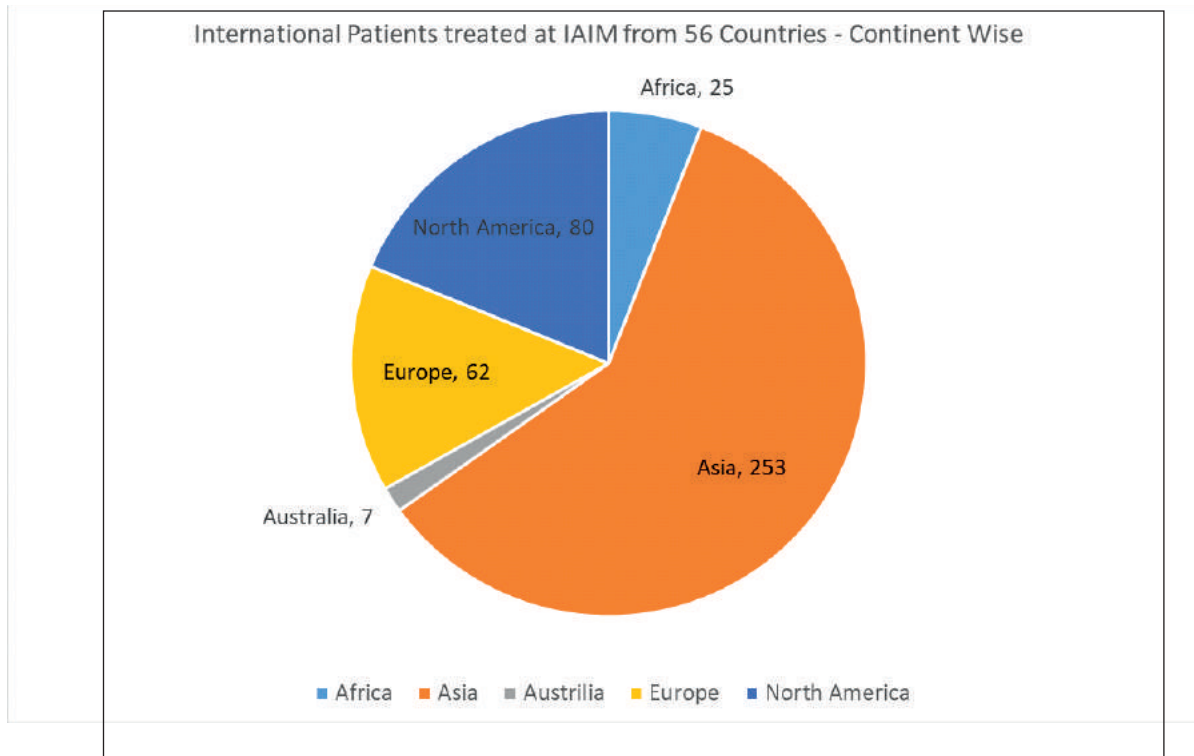
Total Patients treated at IAIM during 2017 – 2018	
In – Patients	1277
Out – Patients	29,482



Institute of Ayurveda and Integrative Medicine Hospital

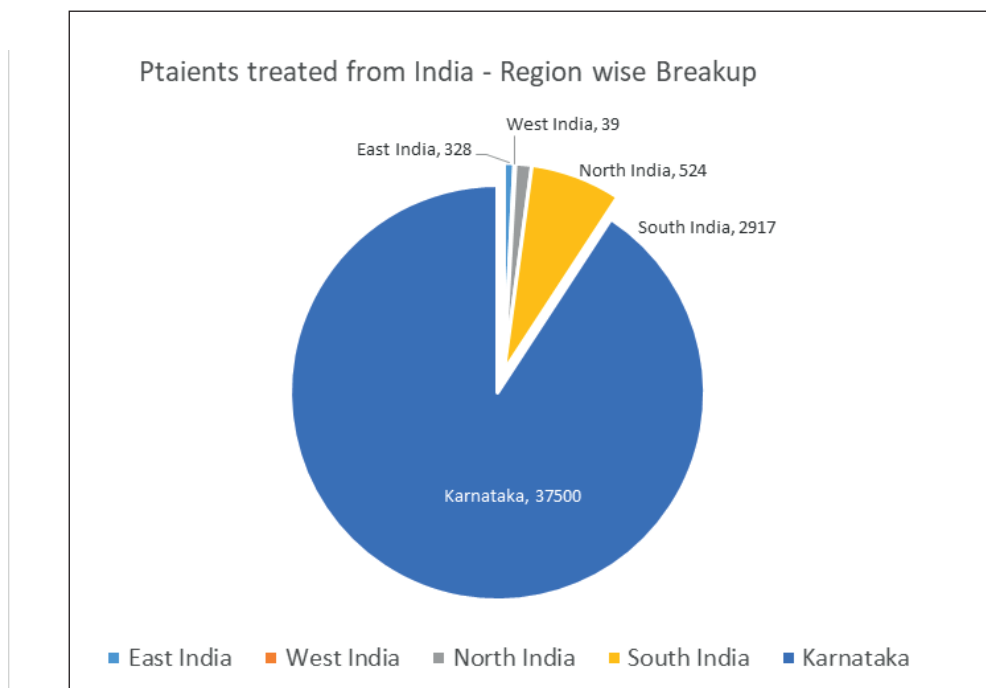


International patients treated at I-AIM from 56 countries - continent wise



Institute of Ayurveda and Integrative Medicine Hospital

International patients treated at I-AIM from 56 countries - continent wise



Testimonials from Patients

1. Mr. Suresh Parthasarathy: Amazing place, awesome hospitality. Feels more like home than hospital. Please don't change anything. Food is amazing as well.
2. Mrs. Seethalakshmi: The entire treatment was very good and very much satisfactory. All the staff connector with the treatment, room maintenance, housekeeping, canteen are very cooperative and help full. In addition, the staff of billing, pharmacy and lab also may co-operative and keep it. The services of all employees are excellent.

Technical presentations delivered by our Physicians at other institutes

1. Dr. Girish Kumar, Sr. Asst. Professor, IAIM made presentation for Central Reserve Police Force on "Healthy Living, An Ayurvedic perspective" and for Karnataka Pollution Control Board on "Ayurveda for Wellness" and for Doordarshan on "Ayurveda for Wellness" and for Mysore Sandal Soap Factory on "Ayurveda for Wellness"
2. Dr. Yashaswini, Medical Officer, IAIM made presentation for Karnataka Pollution Control Board on "Way to Swasthya- Way to Healthy Living"
3. Dr. Prasanna Kulkarni, Clinical Registrar, IAIM made presentation for Griffith Foods on "Swasthya-Ayurveda understanding of health & Prakruti Analysis-Knowing one's own Nature"
4. Dr. Neelambika, Clinical Registrar, IAIM made presentation for Mysore Sandal Soap Factory on "Ayurvedic Management of UTI".

8 Symposium on “Traditional Health Knowledge Inspired Nutraceuticals”

The TDU-Amway symposium on “***Traditional Health Knowledge Inspired Nutraceuticals***” was held on March 6, 2018, at Royal Orchid Resort & Convention Centre, Bengaluru, India. The symposium was jointly organized by The University of Trans-Disciplinary Health Sciences and Technology (TDU) and Amway-Nutriline, USA. 120 scientists, research scholars, academicians and industrial representatives in the field of health from India and abroad participated in the symposium.

Shri Darshan Shankar - Chief Patron, Dr. Navin Sharma - Symposium Organizer, Dr. Bhagya V Rao - Organizing Secretary of the symposium. The proceedings of the symposium “***Perspectives in translating insights from global traditional medicines through modern sciences***” was released by all dignitaries in the inaugural function. Dr. Navin Sharma gave the welcome address and emphasized the need for translating traditional knowledge concepts, validated through modern science and converting these concepts into products.

This symposium was designed to bring to light the time tested knowledge of Ayurveda, an Indian traditional health system, Traditional Chinese Medicine, Traditional Korean Medicine and Native European Traditional Health knowledge inspired Nutraceuticals for the benefit of humankind. The key note speakers of the symposium were Shri Darshan Shankar (TDU, Bengaluru, India), Prof. Rama Jayasundar (AIIMS, New Delhi, India), Dr. Mitali Mukerji (IGIB, New Delhi, India), Dr. Bhavana Prasher (IGIB, New Delhi, India), Dr. Yanze Liu (Chinese Academy of Medical Sciences, Beijing, China), Dr. Hocheol Kim (Kyung Hee University, Korea), Prof. Mauro Serafini (Sapienza University of Rome, Italy) and Dr. Yang Ye (Chinese Academy of Sciences, Shanghai, China).

There were two scientific sessions, one in the morning and one in the afternoon. The first scientific session was dedicated to Indian traditional knowledge and its relevance to nutraceuticals field. The second scientific session started and was dedicated to the traditional knowledge systems of China, Korea and Europe and their relevance to nutraceuticals field. During poster presentations, 30 scholars and practitioners of life science and Ayurveda from around the country presented scientific poster papers on various topics ranging from experimental studies, case studies, clinical experiences, drug trials etc. The grand finale was the panel discussion steered and anchored by Dr. Amit Chandra, Amway, USA. All the speakers of the scientific session were part of this panel discussion.

Symposium on “Traditional Health Knowledge Inspired Nutraceuticals”



Figure 2: Panel discussion



Figure 1: Poster presentation



Figure 3: Cultural program - Bharatanatyam performance

9 Accounts and Financial Statements

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

BALANCE SHEET AS AT MARCH 31, 2018

Corpus & Liabilities	SCH REF	As at 31st Mar	As at 31st Mar	Assets	SCH REF	As at 31st Mar	As at 31st Mar
		2018	2017			2018	2017
		Rs.	Rs.			Rs.	Rs.
General Fund (Deficit)	A	(8,56,72,743)	(3,12,46,042)	Fixed Assets	E	80,01,259	22,45,824
Reserves	B	23,45,211	78,188	Investments	F	1,35,53,000	68,91,000
Project Grants	C	4,32,40,998	29,48,915	Fixed deposits / Bonds			
Current Liabilities	D	8,70,46,892	5,40,02,310	<u>Assets, Loans and Advances</u>			
				Cash on hand	-	57,368	70,856
				Balances with Bank	G	2,24,33,846	1,54,20,023
				Non-Current Assets	H	1,00,000	1,00,000
				Other Current Assets	I	21,44,540	9,50,262
				Loans and Advances	J	6,70,345	1,05,406
Total		4,69,60,358	2,57,83,371	Total		4,69,60,358	2,57,83,371

Notes A) to J) referred to above and Notes to the accounts (Note No. L) form an integral part of this Balance Sheet.

For University of Transdisciplinary Health Sciences & Technology

Place: Bangalore
Date : 01/09/2018


(Professor Darshan Shankar)
Vice-Chancellor


(R Girisharan)
Registrar


(Suresh Hegde)
Deputy 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 : 01/09/2018

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

BALANCE SHEET AS AT MARCH 31, 2018


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For University of Transdisciplinary Health Sciences & Technology

Place: Bangalore
Date : 01/09/2018


(Professor Darshan Shankar)
Vice-Chancellor


(R Girisharan)
Registrar


(Suresh Hegde)
Deputy 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 : 01/09/2018

Accounts and Financial Statements

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

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2018

Expenditure	Year ended 31/03/2018		Income	Year ended 31/03/2018	
	Rs.	Rs.		Rs.	Rs.
Research Projects Expenditure (Note K)			A) Research Projects		
Books, Periodicals & Other Literature	30,708		Project Income Recognition (to the extent of Project funds/Grants utilised as in Schedule 'C')	2,70,78,573	
Communication Costs	27,895		Consultancy Income	91,39,513	
Consultants & Outsourced Services	55,84,524		Interest on Savings Bank A/c	27,035	3,62,45,121
Consumables	15,09,672				
Field Work & Trials	1,10,386		University Income		
IT Hardware, Software & Services	8,319				
Maintenance, Utilities, Repairs & Improvements	2,850		Income on Investments & SB Account		
Meeting, Conferences & Workshop	1,48,273		a) Interest on Fixed Deposits	4,61,851	
Other Overheads & Contingencies	46,46,967		b) Interest on Savings Bank A/c	3,90,805	8,52,656
Printing & Stationery	4,25,857				
Communication & Dissemination	8,500		B) Other Incomes		
Salaries Including Fellowships	1,12,03,384		a) Fees on Projects		43,63,353
Training & Capacity Building	28,793				
Travel & Conveyance	33,41,045	2,70,78,573	Income from Other Sources		
			a) Hostel & Guest House Fees	18,14,617	
University Expenses			b) Recovery from Transport Facility	8,22,777	
Books, Periodicals & Other Literature	97,993		c) Training Fees	23,36,936	
Communication Costs	9,55,582		d) Miscellaneous Income	2,97,018	
Consultants & Outsourced Services	41,80,422		e) Royalty Income	35,813	53,07,161
Consumables	4,15,991				
Field Work & Trials	3,748		University Course Fees		29,49,250
IT Hardware, Software & Services	4,70,648				
Maintenance, Utilities, Repairs & Improvements	95,36,005		Excess of Expenditure over Income for the year transferred to Income & Expenditure Appropriation account (overleaf)		4,55,57,362
Meeting, Conferences & Workshop	12,55,755				
Other Overheads & Contingencies	22,79,891				
Printing & Stationery	10,76,435				
Communication & Dissemination	14,12,387				
Salaries Including Fellowships	4,24,94,335				
Training & Capacity Building	13,000				
Travel & Conveyance	19,89,840	6,62,92,032			
Depreciation (Note E)		19,04,298			
Total		9,52,74,903	Total		9,52,74,903

I & E ACCOUNT PAGE ...1



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

INCOME AND EXPENDITURE APPROPRIATION ACCOUNT FOR THE YEAR ENDED 31/03/2018

Particulars	Year ended 31/03/2018	Particulars	Year ended 31/03/2018
	Rs.		Rs.
Excess of Expenditure over income for the year b/d	4,55,57,362		
Project Income transferred to Project Funds (Schedule C)	91,66,548	Depreciation for the year on assets acquired through project funds transferred to Reserves for Fixed Assets (Schedule B)	2,97,209
		Excess of Expenditure over income for the year transferred to General Fund (Schedule A)	5,44,26,701
Total	5,47,23,910	Total	5,47,23,910

Notes 'B', 'C', 'E' and 'K' referred to above and Notes to the accounts (Note No. 4) form an integral part of this Income and Expenditure account.

For University of Transdisciplinary Health Sciences & Technology

Place: Bangalore
Date: 01/09/2018

(Signature)
(Professor Darshan Shankar)
Vice-Chancellor

(Signature)
(R Giridharan)
Registrar

(Signature)
(Suresh Hegde)
Deputy 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: 01/09/2018

END OF I & E ACCOUNT PAGE ...2

LAWRENCE TELLIS & ASSOCIATES
Chartered Accountants
No. 44/45, 2nd Floor, Vinayaka Complex
Residency Cross Road, Bangalore - 560 025
Ph.: 41514791/92/93
(FIRM ICAI REGN. No. 0018575)

Accounts and Financial Statements

FOUNDATION FOR REVITALISATION OF LOCAL HEALTH TRADITIONS (FRLHT)
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064



BALANCE SHEET AS AT 31ST MARCH 2018

CORPUS FUNDS, CAPITAL FUNDS & LIABILITIES	SCH REF	As at 31st March 2018	As at 31st March 2017
FUNDS AND RESERVES			
General Fund	A	13,42,38,692	11,14,21,637
Reserve Fund	B	16,68,06,281	17,60,03,129
Corpus Funds	C	45,29,02,184	44,90,36,184
Earmarked Funds (Appropriation Funds)	D	10,87,55,200	8,37,10,753
LIABILITIES			
Project Grants/Funds	E	4,24,66,756	4,69,70,829
Non-Current Liabilities	F	74,78,768	1,36,49,432
Current Liabilities	G	1,50,30,407	62,52,695
TOTAL		92,76,78,288	88,70,44,659
PROPERTIES AND ASSETS			
Fixed Assets	H	16,68,06,280	17,60,03,129
INVESTMENTS			
Corpus Investments	I	45,29,02,184	44,90,36,184
Other Investments	J	12,08,39,789	8,96,88,910
OTHER ASSETS			
Assets, Loans and Advances			
Cash on hand	-	4,97,106	4,36,486
Bank balances	K	6,66,08,212	7,30,46,965
Non-Current Assets	L	86,28,288	1,43,81,952
Other Current Assets	M	2,33,24,212	2,55,10,091
Stock of Pharmacy Stores	N	23,93,611	28,65,505
Loans and Advances	O	8,56,78,605	5,60,75,437
TOTAL		92,76,78,288	88,70,44,659

Notes A) to O) referred to above and Notes to the accounts (Schedule-U) form an integral part of this Balance Sheet.

For Foundation For Revitalisation of Local Health Traditions (FRLHT)

Place: Bangalore
Date: 03/09/2018


(Darshan Shankar)
Managing Trustee


(S. Ramaswamy)
Trustee


(Suresh Hegde)
Asst. Director -
Finance & Accounts



Place: Bangalore
Date: 03/09/2018

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



LAWRENCE TELLIS & ASSOCIATES
Chartered Accountants
No. 44/45, 2nd Floor, Vinayaka Complex
Residency Cross Road, Bangalore - 560 025
Ph.: 41514791/92/93

Accounts and Financial Statements

FOUNDATION FOR REVITALISATION OF LOCAL HEALTH TRADITIONS (FRLHT)
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064



INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2018

(Amount in Rs.)

Income	Grants/Project Income (Schedule P)	Hospital Income (I AIM Health Care Centre)	Other Income (Schedule Q)	Total Income
Donations received	-	52,000	2,72,39,495	2,72,91,495
Ethno Medical Garden - Sale of Medicinal Plants	-	-	37,81,244	37,81,244
Hospital - Sales	-	3,31,86,627	-	3,31,86,627
Hospital - Receipts	-	7,52,01,099	-	7,52,01,099
Fees on Projects	-	5,72,149	19,33,795	25,05,944
Interest on Savings Bank accounts [Project (Grants) investments-Schedule-'P']	7,41,146	-	-	7,41,146
Interest on Savings bank accounts	-	2,95,405	23,77,509	26,72,914
Interest on Fixed Deposits - Corpus Investments	-	-	4,31,87,374	4,31,87,374
Interest on Fixed Deposits accounts [Project (Grants) investments-Schedule-'P']	2,81,085	-	-	2,81,085
Interest on Fixed Deposits - Other Investments	-	28,10,457	44,33,041	72,43,498
Miscellaneous Income	-	-	8,17,966	8,17,966
Rent Income	-	-	7,48,445	7,48,445
Training Income	12,64,336	-	-	12,64,336
TOTAL INCOME A]	22,86,567	11,21,17,737	8,45,18,869	19,89,23,173

Expenditure	Grants/Project Expenses	Hospital Expenses (I AIM Health Care Centre)	Other / Administration Expenses (Schedule S)	Total Expenditure
Hospital - Purchase & Cost of Goods Sold	-	2,15,04,748	-	2,15,04,748
Books, Periodicals & Other Literature	-	53,865	1,58,567	2,12,432
Communication Costs	-	4,33,166	54,604	4,87,770
Consultants & Outsourced Services	-	1,81,40,473	47,08,910	2,28,49,383
Communication & Dissemination	-	3,40,394	-	3,40,394
Consumables	-	55,61,939	8,99,247	64,61,186
IAIM Research Expenses	-	-	1,07,64,361	1,07,64,361
IT Hardware, Software & Services	-	-	1,72,252	1,72,252
Maintenance, Utilities, Repairs & Improvements	-	40,46,485	13,09,624	53,56,109
Meeting, Conferences & Workshop	-	-	74,341	74,341
Other Overheads & Contingencies	-	59,73,883	11,70,542	71,44,425
Printing & Multimedia Publishing	-	5,21,895	1,03,820	6,25,715
Salaries Including Fellowships	-	5,62,36,574	74,59,908	6,36,96,482
Training & Capacity Building	-	-	34,438	34,438
Travel & Conveyance	-	15,31,404	9,27,437	24,58,841
Sub Total B-1]	-	11,43,44,826	2,78,38,051	14,21,82,877

(Increase) / Decrease in Inventories (Schedule T)	B-2]	-	4,71,894	-	4,71,894
Depreciation (Schedule H)	B-3]	-	-	1,94,93,106	1,94,93,106

TOTAL EXPENDITURE	B = B-1] + B-2] + B-3]	-	11,48,16,720	4,73,31,157	16,21,47,877
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EXCESS/(DEFICIT) OF INCOME OVER EXPENDITURE FOR THE YEAR	C] = A] - B]	22,86,567	(26,98,983)	3,71,87,712	3,67,75,296
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I & E A/C (PAGE1)



Accounts and Financial Statements

FOUNDATION FOR REVITALISATION OF LOCAL HEALTH TRADITIONS (FRLHT)
74/Z, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064



INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2018

(Amount in Rs.)

Particulars	Grants/Project Income (Schedule P)	Hospital Income (I AIM Health Care Centre)	Other Income (Schedule Q)	Total Income
Excess of Income over Expenditure for the year b/d	22,86,567	(26,98,983)	3,71,87,712	3,67,75,296
Appropriations:				
Project income transferred to the respective Project (Grants) Funds (Schedule E)	12,64,336			12,64,336
Income accrued on project fund investments transferred to the respective Project (Grants) Funds (Schedule E)	10,22,231			10,22,231
(Deficit)/Excess of income over expenditure transferred to General Fund (Schedule A)		(26,98,983)	2,78,12,717	2,51,13,734
Excess of income over expenditure transferred to Earmarked Funds (Schedule D)			3,62,41,026	3,62,41,026
Excess of income over expenditure transferred to Corpus Funds (Schedule C)			37,66,000	37,66,000
Amount transferred from Reserves for Fixed Assets to the extent of Depreciation for the year (Schedule B)			(1,94,93,106)	(1,94,93,106)
Amount transferred from balances in Income accretion to respective Funds to the extent of expenses incurred during the year allocable to interest accrued on Earmarked Funds (Schedule D)			(1,11,38,925)	(1,11,38,925)
Total	22,86,567	(26,98,983)	3,71,87,712	3,67,75,296

Schedules 'A','B','D','E','H','P' to 'T' referred to above and Notes to the accounts (Schedule U) form an integral part of this Income and Expenditure account.

For Foundation For Revitalisation of Local Health Traditions (FRLHT)

Place : Bangalore
Date : 03/09/2018

(Darshan Shankar)
Managing Trustee

(S. Ramaswamy)
Trustee

(Suresh Hegde)
Asst. Director - Finance & Accounts



Place: Bangalore
Date : 03/09/2018

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



END OF I & E A/C (PAGE2)

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

Accounts and Financial Statements

FOUNDATION FOR REVITALISATION OF LOCAL HEALTH TRADITIONS (FRLHT)
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064



RECEIPTS & PAYMENTS ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2018

(Amount in Rs.)

Receipts	Projects	Hospital	Others	Total
OPENING BALANCES AS ON 01/04/2017				
Bank Balances (Corpus & Non-Corpus) (Schedule -K)	1,08,26,007	56,60,058	5,65,60,900	7,30,46,965
Cash Balance (Non-Corpus)	500	2,28,263	2,07,723	4,36,486
RECEIPTS DURING THE YEAR				
Donations Receipts	-	52,000	2,73,39,495	2,73,91,495
Ethno Medical Garden	-	-	37,81,244	37,81,244
Hospital - Sales	-	3,30,95,230	-	3,30,95,230
Hospital Receipts	-	7,52,01,099	-	7,52,01,099
Contribution/Recoveries from Projects towards overhead charges	-	5,72,149	19,33,795	25,05,944
Interest on Savings Bank accounts	7,41,146	2,95,405	23,77,509	34,14,060
Interest on Fixed Deposits - Corpus Investments	-	-	4,77,00,403	4,77,00,403
Interest on Fixed Deposits - Other Investments	2,74,879	24,56,714	31,26,620	58,58,213
Miscellaneous income	-	-	3,17,966	3,17,966
Rent Income	-	-	7,43,945	7,43,945
Training Income	12,64,336	-	-	12,64,336
Project Grants received (Tied-up Grants)	4,93,38,400	-	-	4,93,38,400
Other Receipts				
Rent Deposits Received	-	-	14,80,075	14,80,075
Refund of Advances	-	1,82,883	1,08,285	2,91,168
Electricity, Patients & Other Deposits received	-	89,75,580	-	89,75,580
Corpus Investments matured during the year	-	-	1,75,226	1,75,226
Other Investments matured during the year	-	2,38,06,668	4,45,37,576	6,83,44,244
Inter-unit transfers (as per Contra)	31,47,475	-	-	31,47,475
TOTAL	6,55,92,743	15,05,26,049	19,03,90,762	40,65,09,554

PAYMENTS DURING THE YEAR	Projects	Hospital	Others	Total
Hospital - Purchases	-	1,95,61,318	-	1,95,61,318
Books, Periodicals & Other Literature	11,545	49,955	1,58,567	2,20,067
Communication Costs	97,552	3,30,225	60,475	4,88,252
Consultants & Outsourced Services	79,25,549	1,69,92,936	42,70,844	2,91,89,329
Consumables	58,35,668	51,52,822	8,99,247	1,18,87,737
Field Works & Trials	1,42,955	-	-	1,42,955
Fee/Concessional treatment for poor patients	63,17,560	-	-	63,17,560
IAM Research Expenses	-	-	1,07,64,361	1,07,64,361
IT Hardware, Software & Services	2,58,980	-	2,23,696	4,82,676
Maintenance, Utilities, Repairs & Improvements	2,71,431	38,79,666	13,90,700	55,41,797
Communication & Dissemination	-	3,40,394	-	3,40,394
Meeting, Conferences & Workshop	4,75,334	-	74,341	5,49,675
Other Overheads & Contingencies	26,79,534	60,31,149	13,42,244	1,00,52,927
Printing & Multimedia Publishing	5,98,914	4,38,951	1,03,820	11,41,685
Salaries Including Fellowships	1,71,59,335	5,21,88,062	74,59,908	7,68,07,305
Training & Capacity Building	1,32,308	-	34,438	1,66,746
Travel & Conveyance	41,28,636	14,84,517	9,27,437	65,40,590
Fixed Assets acquired/purchased	67,99,608	6,03,539	16,98,177	91,01,324
Return of Un-utilised Grants	3,27,401	-	-	3,27,401
c/fd	5,31,62,310	10,70,53,534	2,94,08,255	18,96,24,099

R & P A/C (PAGE1)



Accounts and Financial Statements

FOUNDATION FOR REVITALISATION OF LOCAL HEALTH TRADITIONS (FRLHT)
74/2, Jarakabande Kaval, Post Attur, Yelahanka, Bangalore 560 064



RECEIPTS & PAYMENTS ACCOUNT FOR THE YEAR ENDED 31ST MARCH 2018

(Amount in Rs.)

Payments	Projects	Hospital	Others	Total
b/fd	5,31,62,310	10,70,53,534	2,94,08,255	18,96,24,099
Other Payments				
Loans & Advances	6,19,000	13,81,340	9,81,480	29,81,820
Advance to University of Transdisciplinary Health Sciences & Technology	-	-	2,99,80,788	2,99,80,788
Duties & Taxes Paid	-	1,48,290	-	1,48,290
Electricity, Patients & Other Deposits Paid	-	87,38,340	-	87,38,340
Refund of Rent Deposits	-	-	12,47,075	12,47,075
Corpus Investments made during the year	-	-	40,41,226	40,41,226
Other Investments made during the year	-	2,88,21,169	7,06,73,954	9,94,95,123
Inter-unit transfers (as per Contra)	-	24,89,310	6,58,165	31,47,475
CLOSING BALANCES AS ON 31/03/2018				
Bank Balances (Corpus & Non-Corpus) (Schedule -K)	1,18,02,483	15,22,640	5,32,83,089	6,66,08,212
Cash Balance (Non-Corpus)	8,950	3,71,426	1,16,730	4,97,106
Total	6,55,92,743	15,05,26,049	19,03,90,762	40,65,09,554

For Foundation For Revitalisation of Local Health Traditions (FRLHT)

Place : Bangalore
Date : 03/09/2018

(Darshan Shankar)
Managing Trustee

(S. Ramaswamy)
Trustee

(Suresh Hegde)
Asst. Director - 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



END OF R & P A/C (PAGE2)



Place: Bangalore
Date : 03/09/2018

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



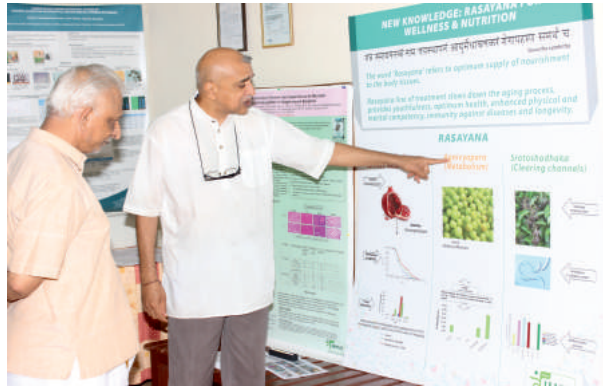
Visit of Kiran Mazumdar Shaw, Chairperson, BIOCON Limited



Visit of Kris Gopalakrishnan, Chairman, Axilor Ventures



Visit of Her Highness Pramoda Devi and Prince Yaduveer Wadiyar



Visit of Sri M, Satsang Foundation



Visit of Sudha Murthy, Chairperson, Infosys Foundation



Visit of Philippe Haydon, CEO, Himalaya Drug Co



Visit of Sri Vajubhai Rudabhai Vala, Governor of Karnataka



Visit of Premji Amaran, chairman of Wipro Limited



THE UNIVERSITY OF TRANS-DISCIPLINARY
HEALTH SCIENCES & TECHNOLOGY

