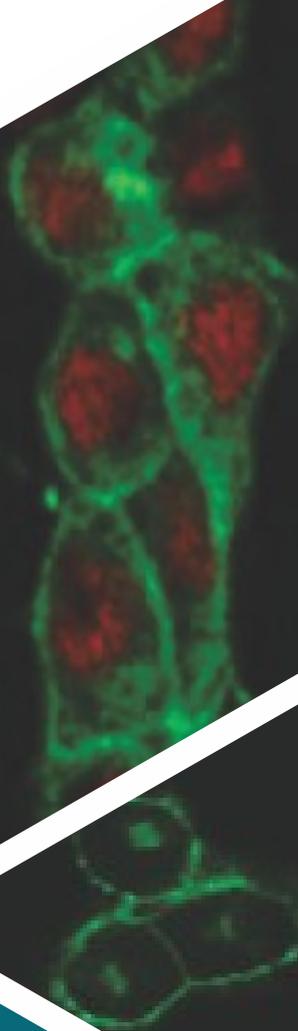




Annual Report 2016-17



Maharashtra Association for the Cultivation of Science
Agharkar Research Institute

Vision

Our goal is to excel as an internationally recognized centre of multi-disciplinary life science research that focuses on industrial development, human health and environment.

Mission

Conduct basic and applied research in life sciences and harness the genetic diversity of microbes, plants and animals towards a cleaner environment, sustainable agriculture and better health of the masses.



ANNUAL REPORT 2016-17



Maharashtra Association for the Cultivation of Science
Agharkar Research Institute

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Dr GK Wagh

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FOREWORD

Dr DR Bapat
President
Maharashtra Association for the Cultivation of Science
Pune

Dear Friends,

I have the pleasure of presenting to you the MACS-ARI annual report for 2016-17. Research in agriculture, health, biodiversity, bioenergy, fundamentals of cell-cell interactions, and nanotechnology have yielded some encouraging results.

Some of these are as follows:

- Wheat variety MACS 3949 has been identified for cultivation in irrigated condition of Peninsular Zone based on its higher yield potential, better disease resistance and pasta quality under timely sown, irrigated condition of Peninsular Zone.
- Soybean variety MACS 1407 has been identified for cultivation in Assam, West Bengal, Jharkhand, Chhattisgarh and North Eastern states.
- To aid the aquaculture industry, shrimp industry to be specific, a lateral flow assay test has been developed. The test takes only 20 minutes and does not require a skilled operator.
- Treatment of type 1 and type 2 diabetic rats with zinc oxide nanoparticles lead to increased levels of phosphorylated protein kinase B resulting in its activation, suggesting improved glucose metabolism in liver as well as muscle.
- DC-LSMO nanoparticles were found to be potential bimodal therapeutic agents for cancer treatment and hold promise against disease recurrence and drug resistance.
- *Eriocaulons* (Pipeworts) have greatest threatened species percentage in the Western Ghats. More than 200 accessions of *Eriocaulon* were identified.
- Investigation of microbial diversity of subseafloor sediments associated with methane hydrate deposits has led to the isolation of a novel methanogen *Methanosarcina* sp MSH10X37.

- Exploration of biodiversity rich areas of Northern Region of Western Ghats yielded an interesting novel species, which was named as *Ischaemum agharkarii* after renowned botanist late Prof. SP Agharkar, Founder-Director of Agharkar Research Institute.

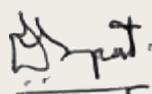
Coming to the popularisation of science and reaching to the society, topics of societal and scientific relevance were addressed in the memorial orations organized by MACS. Dr GB Deodikar Memorial Oration was delivered by Prof. Chandrashekhar P Joshi, Professor and Chair, Department of Biological Sciences, Michigan Technological University, USA on 'Improving Bioenergy Production via Genetic Engineering of Plant Cell Walls'. Prof. DP Biradar, Vice-Chancellor, University of Agricultural Sciences, Dharwad delivered Shri GB Joshi Memorial Oration on 'Climate Change and Crop Productivity'. The 55th Prof. SP Agharkar Memorial Oration was delivered by Dr Anil Kakodkar, INAE Satish Dhawan Chair of Engineering Eminence, Bhabha Atomic Research Centre, Mumbai on 'Getting Ready for Knowledge Era'.

To encourage scientific aptitude, awards such as the Dr RB Ekbote Award in recognition of significant research contribution in the various areas of Botany, Shri VP Gokhale Award in recognition of significant research contribution in the various areas of Phytopathology and Dr PP Kanekar Award for the best paper published by young scientist of MACS-ARI, were given.

MACS continues to organise scientific promotion programmes like Home Gardening and Field Botany. These courses have become very popular.

MACS has continued on its journey of encouraging research, popularising science and reaching to society.

Your suggestions are welcome.



DR Bapat

28 June 2017

EXECUTIVE SUMMARY

Dr KM Paknikar
Director (Officiating)
Agharkar Research Institute
Pune

Dear Readers,

The continued appreciation from you regarding the presentation of the annual report has been instrumental in making it more reader friendly. The past four years have been packed with a lot of developments - both scientific and administrative. The average impact factor of the research publications now stands above 3.0, for the first time.

For the second year running, we have entered into yet another international collaboration by signing a Memorandum of Understanding with Tokyo Gakugei University.

The encouraging support from Department of Science and Technology has emboldened our spirit and boosted our morale. Greater research output of the Institute in comparison to the size of the financial inputs has been appreciated by DST.

Few of the research achievements are summarised below thematically.

Biodiversity & Palaeobiology

Investigation of microbial diversity of subseafloor sediments associated with methane hydrate deposits has led to the isolation of a novel methanogen *Methanosarcina* sp MSH10X37.

Cellulolytic and xylanolytic thermophilic anaerobic bacteria were isolated from hot springs of Maharashtra and Jammu & Kashmir.

Methanotrophs were isolated from various habitats such as roots of rice plants, hot springs and faecal samples of various ruminant animals.

Four new species of anamorphic helicosporous fungi, collected from Western Ghats in Maharashtra, were discovered and their novelty was established.

Identification, validation and documentation of 40 economically important Indian Fusaria was completed based on morphological and sequence analysis of target genes.

Morphoanatomical and chemotaxonomic studies of over 240 lichen specimens have resulted into identification of 60 species.

Profiles for medicinally important species from genus *Solanum* L. and their applications in identification of market samples were studied.

Eriocaulons (Pipeworts) have greatest threatened species percentage in the Western Ghats. More than 200 accessions of *Eriocaulon* were identified.

Exploration of biodiversity rich areas of Northern Region of Western Ghats yielded an interesting novel species, which was named after renowned botanist late Prof. SP Agharkar, Founder-Director of Agharkar Research Institute, as *Ischaemum agharkarii*.

A photographic seed guide, which is first of its kind in India, illustrating seeds of 300 species of flowering plants of Western India was published.

A repository of genuine crude drug resources from five agro-climatic zones of Maharashtra is being developed.

Examination of diatoms from aerophilous habitats has yielded populations of 14 *Luticola* species, including 13 species new to science.

Twenty ichnospecies distributed among 17 ichnogenera have been identified from the Tithonian rocks of the Bhadasar Formation, Jaisalmer Basin, India.

Study of epifaunal to infaunal foraminiferal assemblage widely distributed in intertidal mud flats, sand flats, marshes and seaweed along the coastline of Maharashtra has revealed a variety of foraminiferal diversity.

Bioenergy

Lignite is not a preferred source of fuel because of its low energy density, high moisture content and high emission of CO₂. A microbial consortium was developed for the biomethanation of lignite, which under un-optimized conditions was able to produce methane from lignite at an efficiency of 80-95 ml of biogas per gram of lignite with methane concentration of 26-52 %.

Bioprospecting

Our findings suggest that lichen species of genus *Heterodermia* can be used as new bioresources for the natural lipoxygenase inhibitor with antimicrobial and radical scavenging features.

Inflammation associated anemia is the second most prevalent anemia. We studied the in vivo efficacy of *Guduchi* (*Tinospora cordifolia*) extract in animal model and found significant improvement in hemoglobin levels and total red blood cell levels.

An android system based smartphone app called 'Hb Calculator' for accurate and sensitive measurement of Hb is developed. Its higher sensitivity, specificity, accuracy and reliability makes it an attractive alternative for Hb estimation in resource-limiting conditions.

Developmental Biology

Autophagy is an evolutionarily conserved process in eukaryotic cells that is involved in degradation of cytoplasmic contents including organelles via the lysosome. Our study of the role of autophagy during regeneration in hydra may provide a framework to understand the evolution of autophagy network in higher eukaryotes.

Our collaborative work on zebrafish uncovers that connective tissue growth factor is necessary to stimulate spinal cord regeneration via glial bridging.

Genetics & Plant Breeding

Marker assisted breeding was undertaken for the improvement of grain protein content and gluten strength in the popular bread wheat varieties NI 5439 and MACS 2496 of peninsular region and grain protein and yellow pigment content in the durum wheat varieties MACS

3125 and HI 8498. Based on three years replicated trial data, promising lines for all the targeted traits have been identified.

MACS 3949 durum wheat variety has been identified for cultivation under timely sown, irrigated condition of Peninsular Zone based on its higher yield potential, better disease resistance and pasta quality.

150 quintals of breeder seed of wheat varieties MACS 6478, MACS 6222, MACS 2971, MACS 3125 was supplied to different seed multiplying agencies and farmers.

For rapid dissemination of technologies and smooth flow of seed supply to industry Public Private Partnership (PPP) was renewed for next two years under the umbrella of Indian Tobacco Company (ITC). Thirty wheat Choupal Pradarshan Khets (CPK) were conducted in Ahmednagar, Amravati, Wardha and Yavatmal districts of Maharashtra.

Soybean variety MACS 1407 has been identified for cultivation in the states of Assam, West Bengal, Jharkhand, Chhattisgarh and North Eastern states.

226.80 quintal of breeder seed of soybean was supplied to public and private seed multiplying agencies and farmers.

Demonstrations of recently developed soybean varieties were conducted under PPP mode to popularize the varieties among farmers through Choupal Pradarshan Khet.

Nanobioscience

Treatment of type 1 and type 2 diabetic rats with zinc oxide nanoparticles lead to increased levels of phosphorylated protein kinase B resulting in its activation, suggesting improved glucose metabolism in liver as well as muscle.

We found DC-LSMO nanoparticles to be potential bimodal therapeutic agents for cancer treatment and hold promise against disease recurrence and drug resistance.

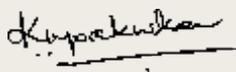
We fabricated microchips using a simplistic microfabrication technique known as soft lithography. The chip can be used in single-cell analyses and generation of tumor-like structures.

We identified a 12-amino acid long peptide for the detection of the white spot syndrome virus in shrimp. The lateral flow assay test requires only 20 minutes. We developed triptorelin tethered multifunctional PAMAM-Histidine-PEG nanoconstructs that enable efficient targeting and gene silencing in breast cancer cells.

The above achievements, in addition to many others, would interest you in going through the relevant matter in this report.

The objectives, vision and mission of MACS-ARI have always centred on benefiting the society. Organisation of *Kisan Melas* is a feature that benefits the farmers through direct interaction with scientists. Home gardening course is being run for the past 28 years. Teaching in secondary schools voluntarily is another activity continued by the institute. Participation in the India International Science Festival, observation of the National Science Day, National Technology Day, Hindi Divas, and Vigilance Awareness Week are in commitment to our national priorities.

Science for society through its fundamental and applied aspects has been the guiding principle of the institute, and which has been appreciated at all levels.



KM Paknikar
28 June 2017

Biodiversity and Palaeobiology Group Scientists



Dr Sanjay K Singh



Dr Bhaskar C Behera



Dr Kantimati G Kulkarni



Dr Paras Nath Singh



Dr Anuradha S Upadhye



Dr Ritesh K Choudhary



Dr Karthick Balasubramanian



Dr Rajesh Kumar KC



Dr Abhishek Baghela



Dr Mandar N Datar



Dr Tushar Kaushik



BIODIVERSITY AND PALAEOBIOLOGY

Investigation of the entire range of life forms including viruses, archaea, bacteria, fungi, lichens, diatoms, plants, and fossil forms is the uniqueness of 'Biodiversity and Palaeobiology' studies at ARI.

Archaea, bacteria

Microbial diversity

Exploration of microbial diversity associated with extreme and pristine habitats including subseafloor sediments and hot springs, besides roots of rice plants and faecal samples of ruminant animals, for taxonomic novelty and industrial applications is a major area of research.

Investigation of microbial diversity of subseafloor sediments associated with methane hydrate deposits

Microbial diversity of subseafloor sediments associated with methane hydrate deposits was investigated. Methane hydrate cores/ sediments from Krishna Godavari Basin were made available by Gas Hydrate Research & Technology Centre, Panvel.

Initial investigation dealt with metagenome analysis for culture independent profiling of the microbial community. It revealed the dominance of bacterial community in subseafloor sediments associated with methane hydrate deposits.

Archaeal community constituted ~1 % of the microbial community. Diverse groups of microorganisms (halophilic, non-halophilic, thermophilic, mesophilic, psychrophilic) were observed. A total of 21 different genera of methanogens were detected. Genus *Methanosphaerula* was found to be unique to sediment sample of gas hydrates whereas genus *Methanosarcina* was the most dominant genus among methanogens. Other significant contributors of methanogenic flora included members of genera *Methanococcus*, *Methanococcoides* and *Methanoculleus*.

Methanogens associated with methane hydrate sediments were enriched and cultivated in the laboratory. Enriched methanogens included methanogens grown over a wide range of temperature (thermophilic, mesophilic and psychrophilic methanogens), salinity (halophilic, halotolerant and halophobic methanogens) and substrates (methanol, trimethylamine, acetate, formate and H₂:CO₂). A novel methanogen of the genus *Methanosarcina* was isolated (Figure 1).

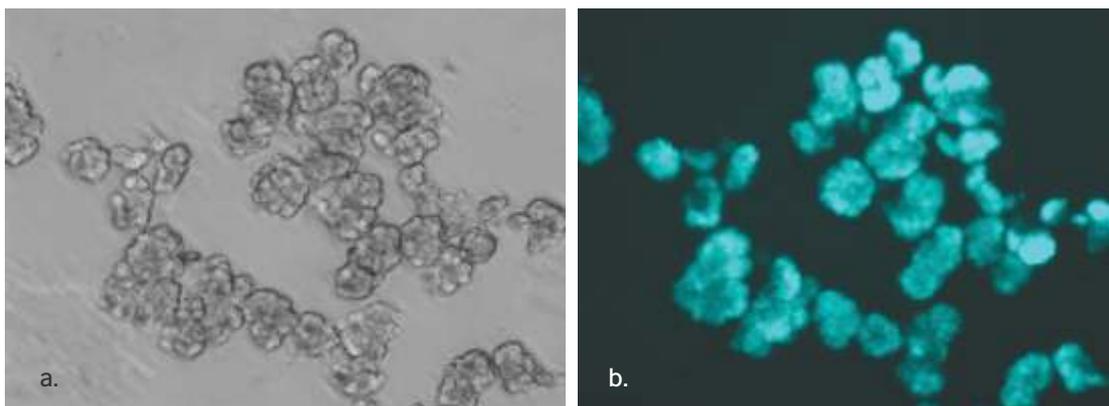


Figure 1

Methanosarcina sp MSH10X37. a. Phase contrast image. b. Cells showing bluish green fluorescence under UV

Isolation of cellulose and xylan degrading thermophilic anaerobic bacteria

Cellulolytic and xylanolytic thermophilic anaerobic bacteria were isolated from Aravali, Rajwadi, Unkeshwar and Unapdeo hot springs of Maharashtra, and Chumatang and Puga hot springs of Ladakh, Jammu & Kashmir.

31 cultures were obtained, 12 of which were identified using molecular tools. Of these, three isolates showed less than 95 % sequence similarity to 16S rRNA gene with the previously reported bacteria, indicating novelty of these cultures. Scanning electron micrograph of a putative novel genus strain X52 (Figure 2) which is phylogenetically closest to genus *Proteiniphilum acetatigenes* DSM 18083^T was conducted.

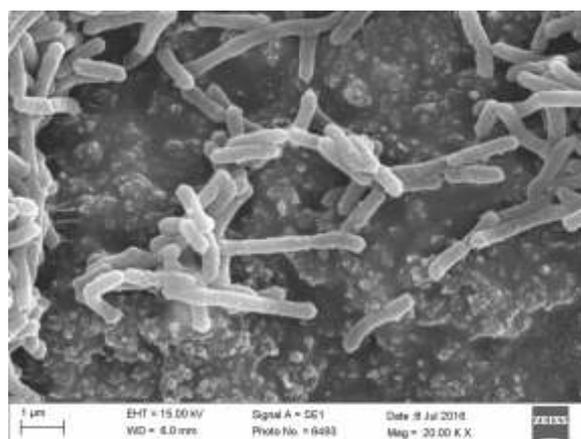


Figure 2

Proteiniphilum sp X52

All isolates were evaluated for their different enzymatic activities viz. CMCase, avicelase, xylanase and production of metabolites like H₂, CO₂, volatile fatty acids, alcohols, etc. Several isolates showed the ability to produce cellulolytic and xylanolytic enzymes to ferment cellulose and xylan to produce ethanol and acetate. Being fibrolytic in nature, these isolates can be used for low-cost hydrolysis and fermentation of lignocellulosic biomass.

Methanotrophs and their applications in methane mitigation

Methanotrophs are environmental biofilters and mitigate methane which is the second most important greenhouse gas. Methanotrophs were isolated from various habitats such as roots of rice plants, hot springs and faecal samples of different ruminant animals.

Our laboratory is among the first laboratories in India to isolate and grow methanotrophic bacteria.

A total of 24 methanotrophic cultures were identified using *pmoA* gene (functional gene) sequencing. Of these, six strains were found to be unique and might represent novel taxa.

Five of the methanotrophic strains isolated from rice roots were used as bioinoculants in cultivated rice variety *Indrayani* in a microcosm experiment. It was found that the inoculated plants showed ~45 % lesser methane emissions and the rhizospheric soil showed ~15 % increased methane oxidation capacity compared to uninoculated controls (Figure 3a and b). This approach could be further explored for methane mitigation from various sources including rice fields.



a. Microcosm experiment: inoculation of methanotroph strains in rice plants. b. Measurement of methane using acrylic chamber

Fungi and Lichens

Taxonomic status of fungal taxa is being revised using bi- and poly-phasic taxonomic tools using multigene sequencing techniques and microsatellite markers. Morphoanatomical and chemotaxonomic studies of lichens have yielded encouraging results.

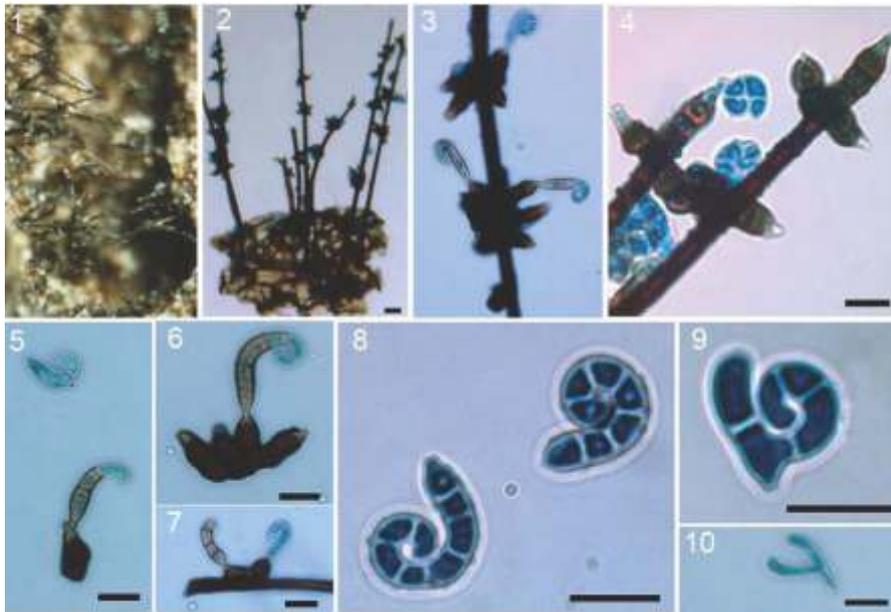
Fungal taxonomy

Four new species of anamorphic helicosporous fungi, collected from the Western Ghats in Maharashtra, namely *Moorella heterosporous*, *Helicoma eucalypti*, *Helicosporium myrtacearum* (collected from *Eucalyptus* sp.) and *H. xylophilous* (collected from unidentified dead wood) were discovered and their novelty was established (Figures 4,5,6,7).

Our attempt to revise fungal family *Beltraniaceae*, based on LSU and ITS-nrDNA sequences and their phylogeny have resolved the taxonomic ambiguities of genera *Beltraniella*, *Porobeltraniella*, *Pseudobeltrania*, *Hemibeltrania* and *Subramaniomyces*. These are now placed under *Beltraniaceae*. Similarly, *Zeuctomorpha arecae* is reduced to synonymy under *Acroconidiellina arecae* (*Sympoventuriaceae*, *Venturiales*, *Dothideomycetes*) based on ITS and LSU sequences derived from a single conidial isolate (NFCCI 3696) (Figure 8).

Identification, validation and documentation of 40 economically important Indian *Fusaria* were completed based on morphological and sequence analysis of target genes (ITS-rDNA & EF-1 α).

An important strain of *Colletotrichum gloeosporioides* (Cgku70 deletion strain) is in the process of yielding, which would have a high rate of homologous recombination; and therefore can become an important strain to be used in the future genetic manipulation studies in this fungus. In another attempt



kinetochore protein of a *Colletotrichum graminicola* is identified using bioinformatics tools, which are being tagged with fluorescent tags to study their cellular localization and their application in identification of centromeres.

Biocontrol of devastating powdery mildew disease caused by *Erysiphe necator* of grapes has been attempted and a few yeast and filamentous fungi showed positive activity.

Figure 4

Moorella heterosporus (AMH 9746, holotype). 1. Stereoscopic view of colonies on the dead bark. 2. Conidiophores emerging from a substrate bearing multiple fertile verticils. 3. Conidiophore and verticils of conidiogenous cells with attached conidia. 4. Magnified view of conidiophores and conidiogenous cells. 5, 6, 7. Conidiogenous cells with attached conidia in different magnifications. 8. Magnified view of helicoid conidia with the truncate base. 9. Magnified view of 'V'-shaped conidium. 10. Magnified view of 'Y' shaped conidium. Bars: 2 = 20 μ m, 3–10 = 20 μ m

Figure 5

Helicoma eucalypti (AMH 9745, holotype). 1. Stereoscopic view of natural colonies on the dead bark. 2. Conidiophores in dense fascicles. 3. Intact fasciculate conidiophores emerging from the substratum. 4. Magnified view basal portion of conidiophores. 5. Magnified view showing branching in conidiophore. 6. Swollen and verruculose terminal portion of a conidiophore bearing acrogenous denticulate conidiogenous cell. 7, 8. Tightly coiled conidia with tapered darkened base. Bars: 2–3 = 20 μ m, 4–8 = 10 μ m



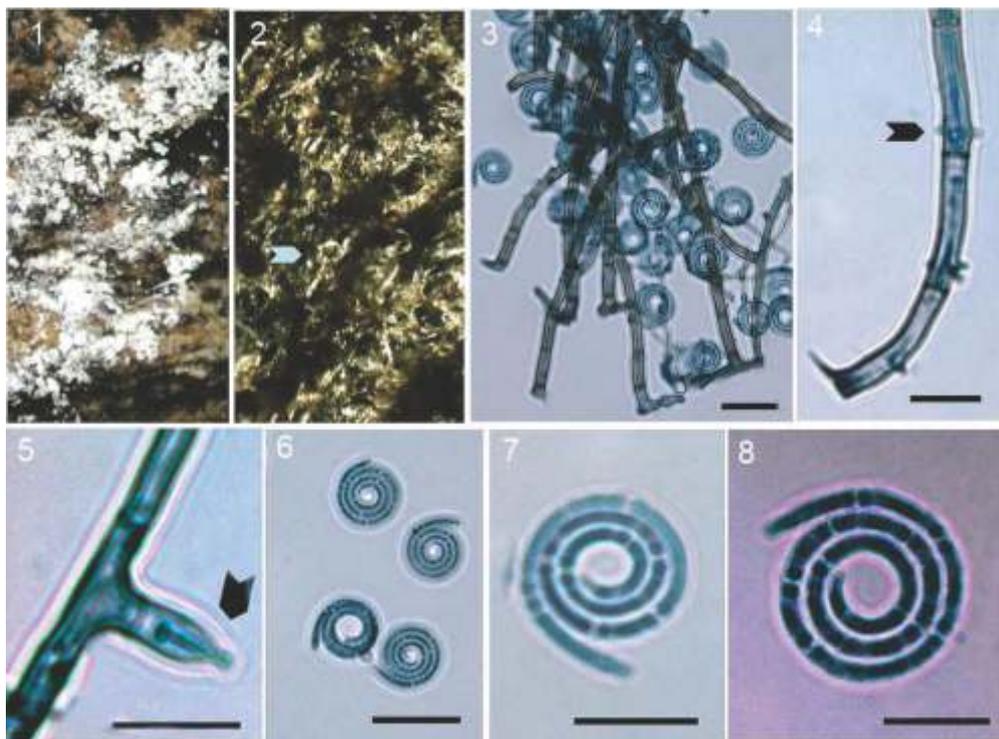


Figure 6

Helicosporium myrtacearum (AMH 9748, holotype). 1. Natural colonies on the dead bark. 2. Stereoscopic view of colonies on the substrate. 3. Conidiophores and conidia. 4. Magnified view of a part of conidiophore (arrow showing denticulate conidiogenous cell). 5. A part of conidiophore bearing ampulliform conidiogenous cell (arrow showing ampulliform conidiogenous cell). 6. Coiled conidia in lower magnification. 7, 8. Magnified view of conidia. Bars: 3 = 20 μ m, 4–8 = 10 μ m

Figure 7

Helicosporium xylophilus (AMH 9744, holotype). 1. Stereoscopic view of natural colonies on dead wood. 2. Conidiophores with the denticulate conidio-genous cell. 3. Branched conidiophore with ampulliform conidiogenous cells and conidia. 4. A part of conidiophore with attached conidia. 5. A conidiophore with terminally attached conidium. 6, 7. Magnified view of conidia. Bars 2-7 = 10 μ m

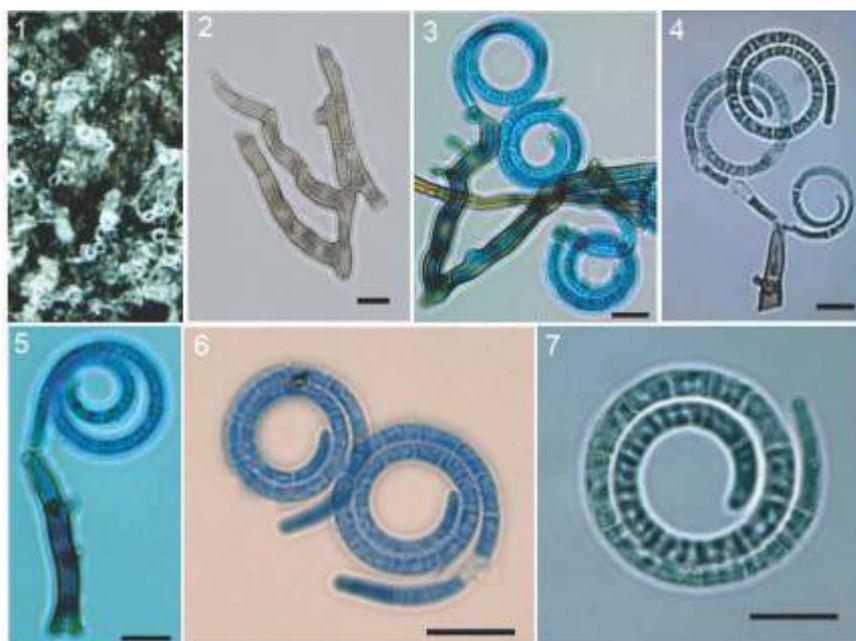




Figure 8

Acroconidiellina arecae (AMH 9676). a, b. Habitat. c–f. Conidiophores and conidiogenous cells. g. Conidia. Scale bars 10 µm

Lichen taxonomy

The morphoanatomical and chemotaxonomic studies of over 240 lichen specimens have resulted in the identification of 60 species belonging to different members of *Parmeliaceae*, *Collemaaceae*, *Peltigeraceae*, *Physciaceae*, *Lobariaceae*, *Ramalinaceae* and *Cladoniaceae* and thelotremoid *Graphidaceae*. One species of the genus *Menegazzia* seems to form a new record to India.

During April-May 2016 over 150 lichen specimens have been collected from different areas in Kullu and Shimla districts, Himachal Pradesh from high-altitude zones ranging 1800-4000 m.

Plants and Diatoms

Medicinal plants, molecular phylogeny, plant endemism, seed guide, crude drug repository, morphological evolution and ecological diversification, diatom indices are being rigorously pursued.

Developing profiles for medicinally important species from genus *Solanum* L. and their applications in identification of market samples

The whole plant of *Kantakari*, the fruit of *Kakmachi* and root and stem of *Brihati* are known as official drugs. The methanolic extracts were subjected to check the comparative phytochemical and antioxidant potentials of these complexes. Fruits of *Solanum villosum* had a higher amount of phytoconstituents (except tannins) and antioxidant activity than *S. americanum*. The whole plant of *S. virginianum* had a greater amount of phytoconstituents and antioxidant activity than *S. viarum*. The stem of *S. anguivi*, *S. torvum* and *S. melongena* had higher phytoconstituents and antioxidant potential than their roots except for *S. incanum*, where root had higher potential than stem extract.

Molecular phylogeny of *Eriocaulon* L. of the Northern Western Ghats, India

Eriocaulons (Pipeworts) have greatest threatened species percentage in the Western Ghats. Molecular phylogenetic studies on the genus are being carried out to assess the congruence of morphological and molecular data, to find the trend of morphological character evolution and to develop possible DNA barcodes. Field trips were conducted to collect specimens from the Western Ghats and Eastern Himalayas. More than 200 accessions of *Eriocaulon* were collected, and all were identified after critical morphological examination. SEM studies on *Eriocaulon* seeds and pollen were carried out for ten species

(Figure 9). DNA isolation was done and three molecular markers namely ITS, *psbA-trnH*, and *trnL-F* regions were amplified and sequenced for 15 species. The preliminary phylogenetic analysis was carried out using Maximum Likelihood and Bayesian algorithms.

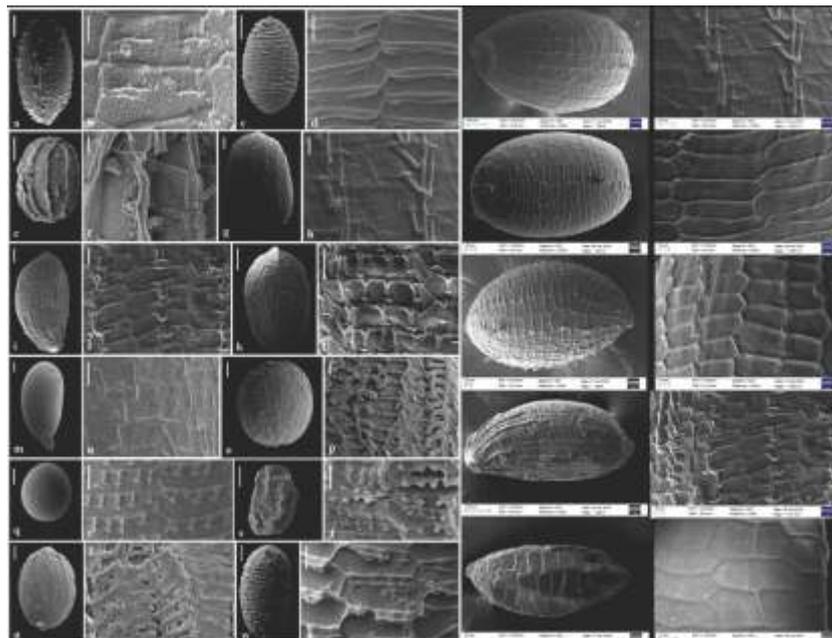
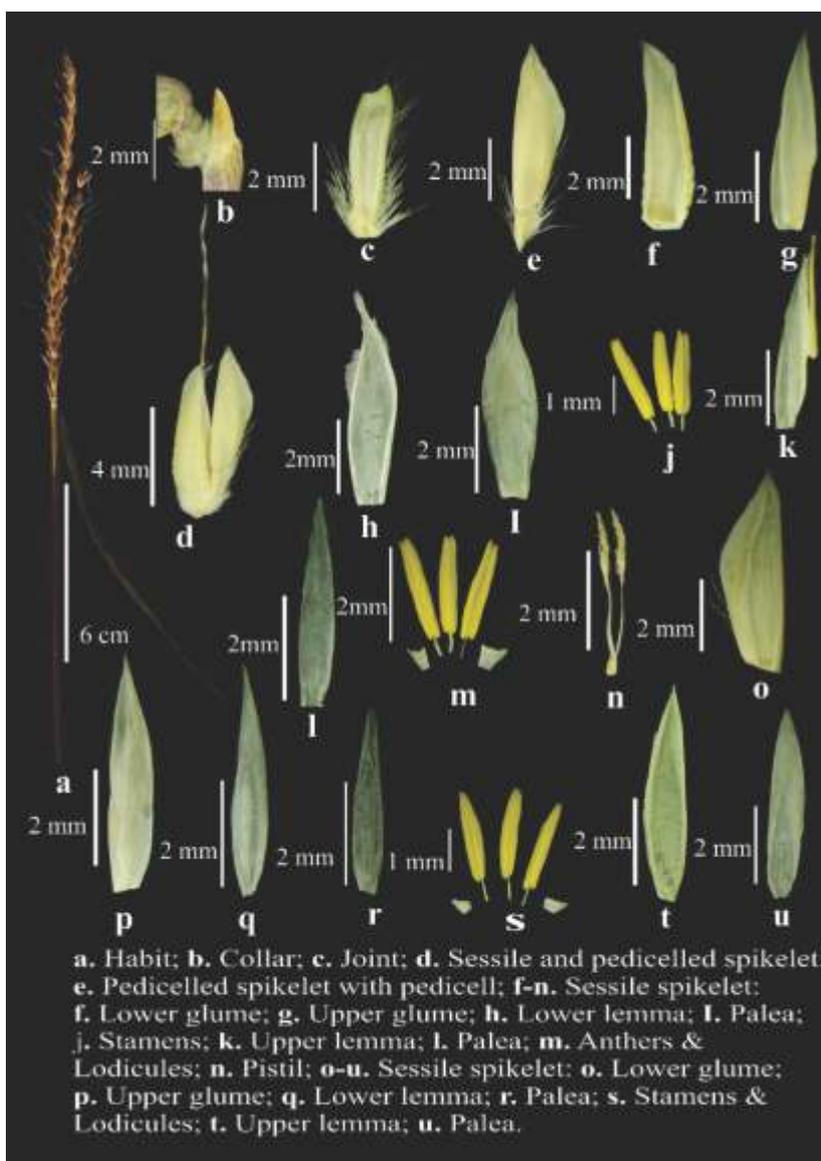


Figure 9

SEM photomicrograph of *Eriocaulon* seeds



Unravelling the vascular plant endemism of Northern region of Western Ghats

Exploration of biodiversity rich areas of Northern Region of the Western Ghats for its diversity yielded an unusual novel species belonging to grass genus *Ischaemum* (Figure 10). The species is named after renowned botanist late Prof. SP Agharkar, Founder-Director of Agharkar Research Institute.

Figure 10

Floral parts of *Ischaemum agharkarii* MN Datar, RK Choudhary and P Gorade

Seeds of Western India

Western India harbors more than 3000 species of flowering plants, but identification of seeds of these species is a tough task in the absence of suitable field guides. A photographic seed guide which is first of its kind in India was published in collaboration with Ela Foundation. The book illustrates seeds of 300 species of flowering plants. Each page is dedicated to one species providing a photograph and other relevant information (Figure 11).

Development of crude drug repository of genuine samples from Maharashtra

Under the RGSTC sponsored project, a repository of genuine crude drug resources from five agro-climatic zones of Maharashtra is being developed. 260 specimens belonging to 50 families were added to the repository. The comparative documentation on exomorphic characters of fresh and dry specimens and their physical constants are being calculated. A significant difference in ash and extractive values from different agro-climatic zones is documented.

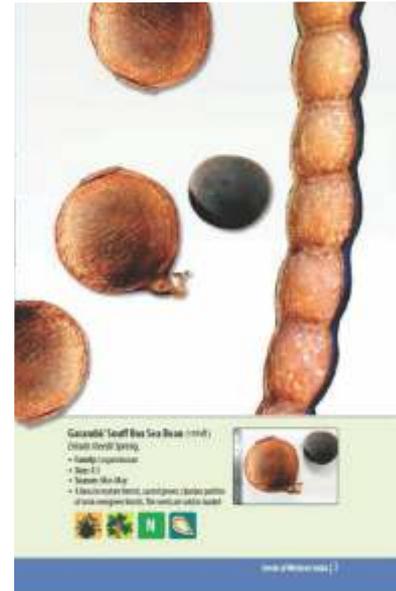


Figure 11

Page illustration of *Entada rheedei* seed (Seeds of Western India)

Understanding the morphological evolution and ecological diversification of the forest dwelling capers in Indian subcontinent using molecular phylogenetic tools

The genus *Capparis* is widely distributed along the pan-tropical region in diverse habitats. In India it is represented by 29 species with a distribution ranging from dry deciduous to evergreen forest types. South India and North-East India are hypothesized to be the centres of speciation for many *Capparis* species. Studies are being carried out to understand morphological evolution and ecological diversification patterns

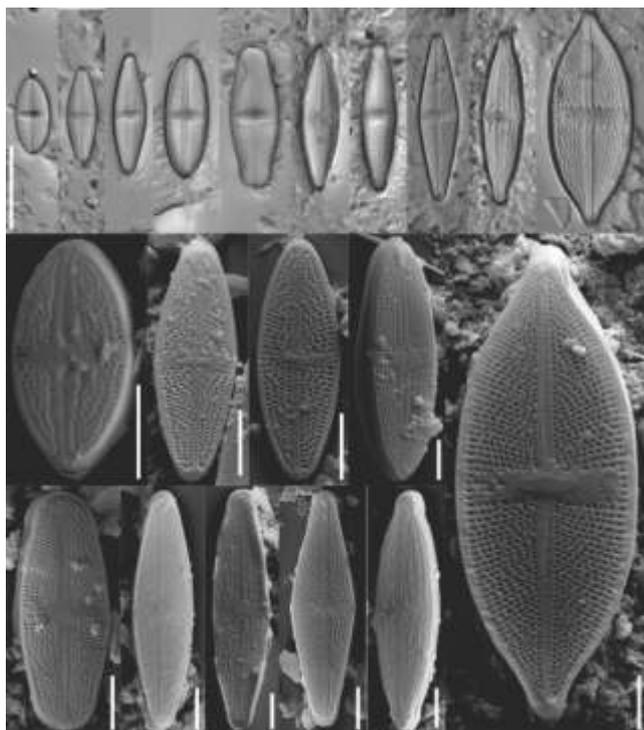


Figure 12

Capparis species collected across India

of *Capparis* species from the Indian subcontinent. Total 55 accessions of *Capparis* comprising 14 species were collected from various regions in India (Figure 12). For molecular studies, DNA extraction was done for all species and amplification will be carried out for chloroplast markers (ndhF, Matk, trnL-F, rbcL) and nuclear internal transcribed spacer (ITS) region. Also, congruence of molecular sequence data and morphological characters will be assessed to understand morphological character evolution.

Do semi-aquatic habitats act as refugia for endemic diatoms in Western and Eastern Ghats



Aerophilous habitats are known as refugia for diatoms and to harbour endemic taxa, especially the spray zones of waterfalls. The ongoing project explores the diatom diversity of these unique habitats in Western and Eastern Ghats. Examination of samples has yielded populations of 14 *Luticola* species, including *L. peguana* (Grunow) D.G. Mann, a species described originally from India, and 13 species new to science. This is equal to about a 5% increase in the global biodiversity of the genus. Observations made to date suggest there are morphological innovations (Figure 13) in the Indian taxa not seen previously in *Luticola*.

Figure 13

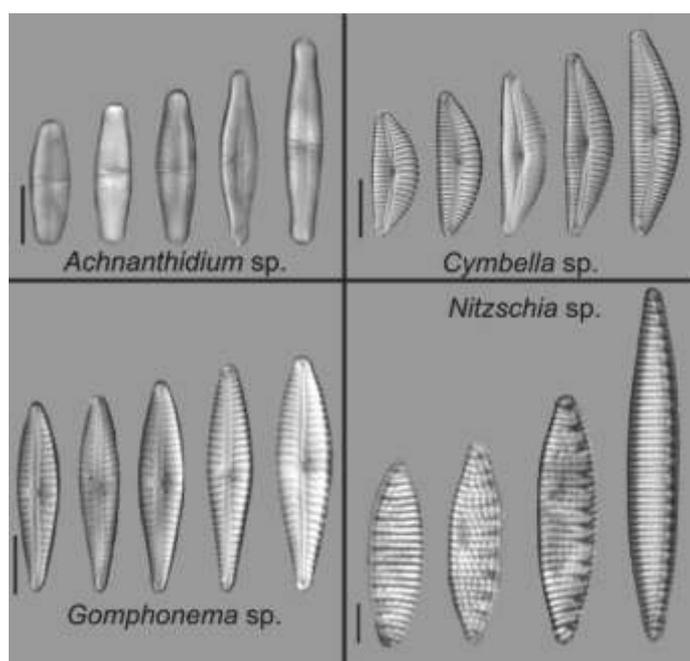
Light microscopic and scanning electron microscopic plates showing the morphological diversity of *Luticola* species from the Western Ghats. Scale bar LM=10 µm and SEM=5 µm

Can diatom communities across spatial and environmental gradients of Western Ghats reflect water quality conditions of streams?

Water quality of streams and rivers of Peninsular India are deteriorating fast affecting the freshwater availability to human usages and posing a severe threat to the

Figure 14

Light microscopic plate of four commonly occurring indicator species from Peninsular Rivers. Scale bar = 10 µm



endemic freshwater biodiversity. The current project aims to develop a diatom-based pollution monitoring system to monitor the water quality status of rivers and streams of Western Ghats. Samples from various riverine sites covering the entire spectrum of pollution have been recorded and illustrated with their autecological information (Figure 14). A numerical index for river quality assessment will now be developed.

Studies on Indian medicinal plants used in oral care for prevention of teeth caries

Streptococcus mutans is known organism for development of tooth caries. In-vitro study was conducted to check the action of methanolic extracts of bark of *Bombax ceiba* L.(Bark), *Albizia lebbeck* (L.) Benth, *Madhuca longifolia* var. *latifolia* (Roxb.) A.Chev. *Mimusops elengi* L. and flowers of *Butea monosperma* (Lam.) Taub. The highest bactericidal activity was found in *Bombax ceiba* L. (Bark) and *Albizia lebbeck* (L.) Benth.

Palaeobiology

Decoding changes in palaeoenvironment using ichnoassemblages, distribution of fossil mega-invertebrates and palynomorphs from different sedimentary basins of peninsular India, and sediment–organism relationship using modern habitats are being studied.

Ichonology of the Upper Jurassic rocks of the Marwar Basin, Rajasthan

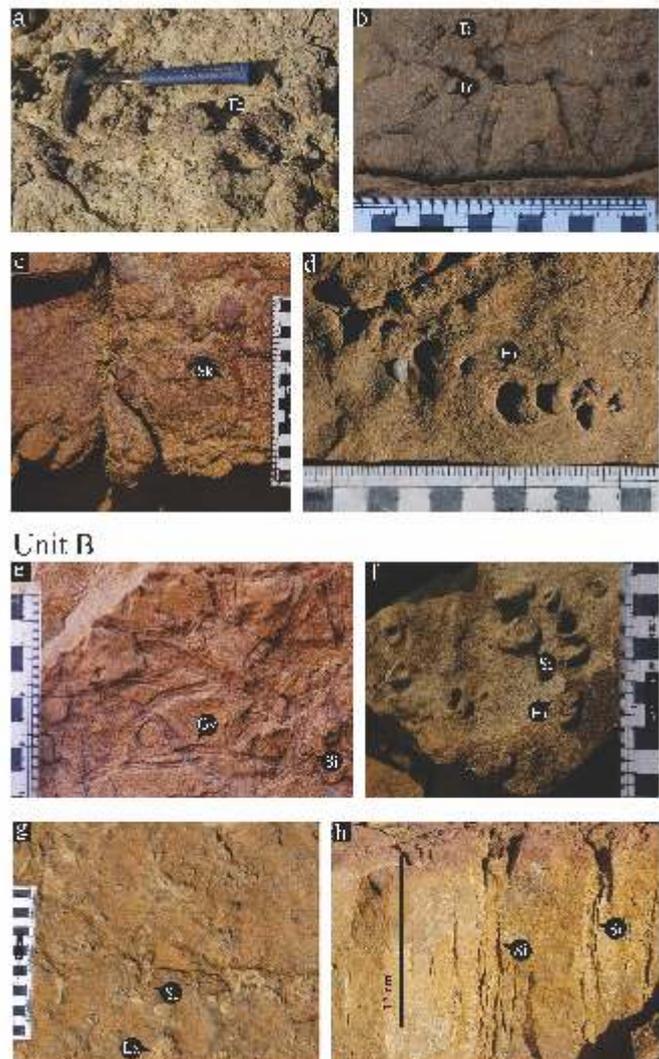
Twenty ichnospecies distributed among 17 ichnogenera have been identified from the Tithonian rocks of the Bhadasar Formation, Jaisalmer Basin, India. The trace fossil assemblages from the Kolar Dungar (informal units A, B & C) and the Mokal (informal unit D) members indicate fluctuations in depositional conditions during the Bhadasar times. Trace fossils *Thalassinoides suevicus*, *Taenidium cameronensis*, *Skolithos linearis*, and *Hillichnus lobosensis* constitute the assemblage of unit A,

Figure 15

Trace fossils occurring in the Kolar Dungar Member, Bhadasar Formation

Unit A: a. Th- *Thalassinoides suevicus*, b. Ta- *Taenidium cameronensis*, c. Sk- *Skolithos linearis* and d. Si- *Siphonichnus ophthalmoides*

Unit B: e. Gy- *Gyrochorte comosa* and Si- *Siphonichnus ophthalmoides*, f. Hi- *Hillichnus lobosensis* and Si- *Siphonichnus ophthalmoides*, g. La- *Laevicyclus parvus* and Si- *Siphonichnus ophthalmoides* and h. Si- *Siphonichnus ophthalmoides*

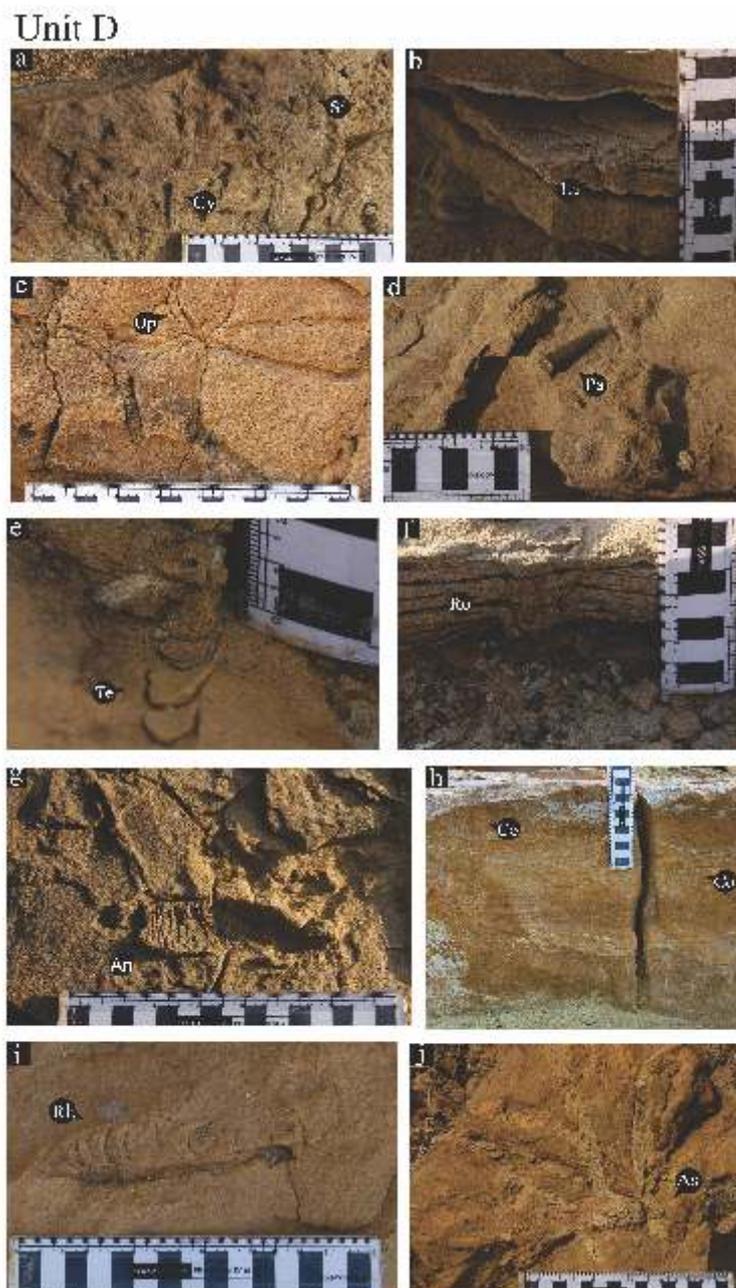


(Figure 15) which represents proximal *Cruziana* ichnofacies which in turn suggests a lower shoreface environment. The ichnoassemblage of unit B consists of *Gyrochorte comosa*, *Siphonichnus ophthalmoides*, *Laevicyclus parvus*, *Hillichnus lobosensis* and *Planolites montanus* (Figure 15) which denotes mixed *Skolithos-Cruziana* ichnofacies indicative of a wave dominated delta front setting. The Mokal Formation (unit D) is characterised by an ichnoassemblage comprising of trace fossils *Gyrochorte comosa*, *Siphonichnus ophthalmoides*, *Laevicyclus parvus*, *Hillichnus lobosensis*, *Conichnus conicus*, *Ancorichnus ancorichnus*, *Ophiomorpha nodosa*, *Rhizocorallium commune*, *Rhizocorallium jenense*, *Teichichnus rectus*, *Taenidium cameronensis*, *Skolithos linearis*, *Palaeophycus tubularis*, *Planolites beverleyensis*, *Planolites montanus*, *Ophiomorpha annulata*, *Asterosoma ludwigae* and *Rosselia socialis* (Figure 16). This assemblage also represents mixed *Skolithos-Cruziana* ichnofacies consequently suggesting a wave-dominated delta front depositional environment. However, it can be surmised that though lithological and sedimentary evidences suggest a wave-dominated delta front environment for both the Kolar Dungan Member (unit B) as well as the Mokal Member (unit D), the ichnoassemblages provide additional inputs elucidating nuances pertaining to energy conditions as well as availability and distribution of nutrients.

Figure 16

Trace fossils occurring in the Mokal Member, Bhadasar Formation

Unit D: a. Gy- *Gyrochorte comosa* and Si- *Siphonichnus ophthalmoides*, b. La- *Laevicyclus parvus*, c. Op- *Ophiomorpha nodosa*, d. Pa- *Palaeophycus tubularis*, e. Te- *Teichichnus rectus*, f. Ro- *Rosselia socialis*, g. An- *Ancorichnus ancorichnus*, h. Co- *Conichnus conicus*, i. Rh- *Rhizocorallium commune* and j. As- *Asterosoma ludwigae*



Tropical peat and peatland development in South-western India during the Holocene

Signatures of peat and peatland development in the Holocene sub-coastal lands and floodplains of Kerala, South-West India (Figure 17) have been decoded with the help of multiple proxies. Unlike older records, the Holocene peat essentially formed in a freshwater swamp environment and the peatland

development started in the incurves of meander loops of fluvial channels since the beginning of Middle Holocene, after the sea level rise around 7,000-6,500 yrs BP. Sea level rise together with excessive rainfall during this period could have provided conducive geo-environmental set up for river meandering in the coastal lands and adjoining parts of the midlands which in turn favoured peatland development (Figure 18). The interruption of peatland development observed in South-West India during the Holocene is attributed to the combined effects of climate variability and sea level oscillations.



Figure 17

Land use / Land cover map of Greater Pamba River Basin showing locations of peat/wood deposits and borehole cores



Figure 18

Selected field sites and sections from the study area

a. Pamba river bank exposing yellowish brown, silty mud with intercalations of sand b. Carbonaceous clay - sand sequence exposed on the bank of Manimala River near Karippumuri kadavu, c. Huge tree trunks exposed on the bottom of the bank of Manimala River, d. A piece of wood embedded in the carbonaceous clays excavated from the Achankovil river basin (near Vettiyar) during the process of a canal construction through its floodplain

Morphological and molecular taxonomic characterization of modern foraminifera from coastal Maharashtra

Study of epifaunal to infaunal foraminiferal assemblage widely distributed in intertidal mud flats, sand flats, marshes and seaweed along the coastline of Maharashtra has revealed a variety of foraminiferal diversity (Figure 19). The species of *Ammonia*, *Rotalidium*, *Haynesia*, *Quinqueloculina* and

Elphidium dominate the assemblage. Reassessment of the taxonomic status of the commonly occurring species of *Ammonia* and *Elphidium* genus along the coastline based on analysis of 18S rRNA gene has offered an alternative tool to the traditional morphotaxonomic approach and solving taxonomic problems.

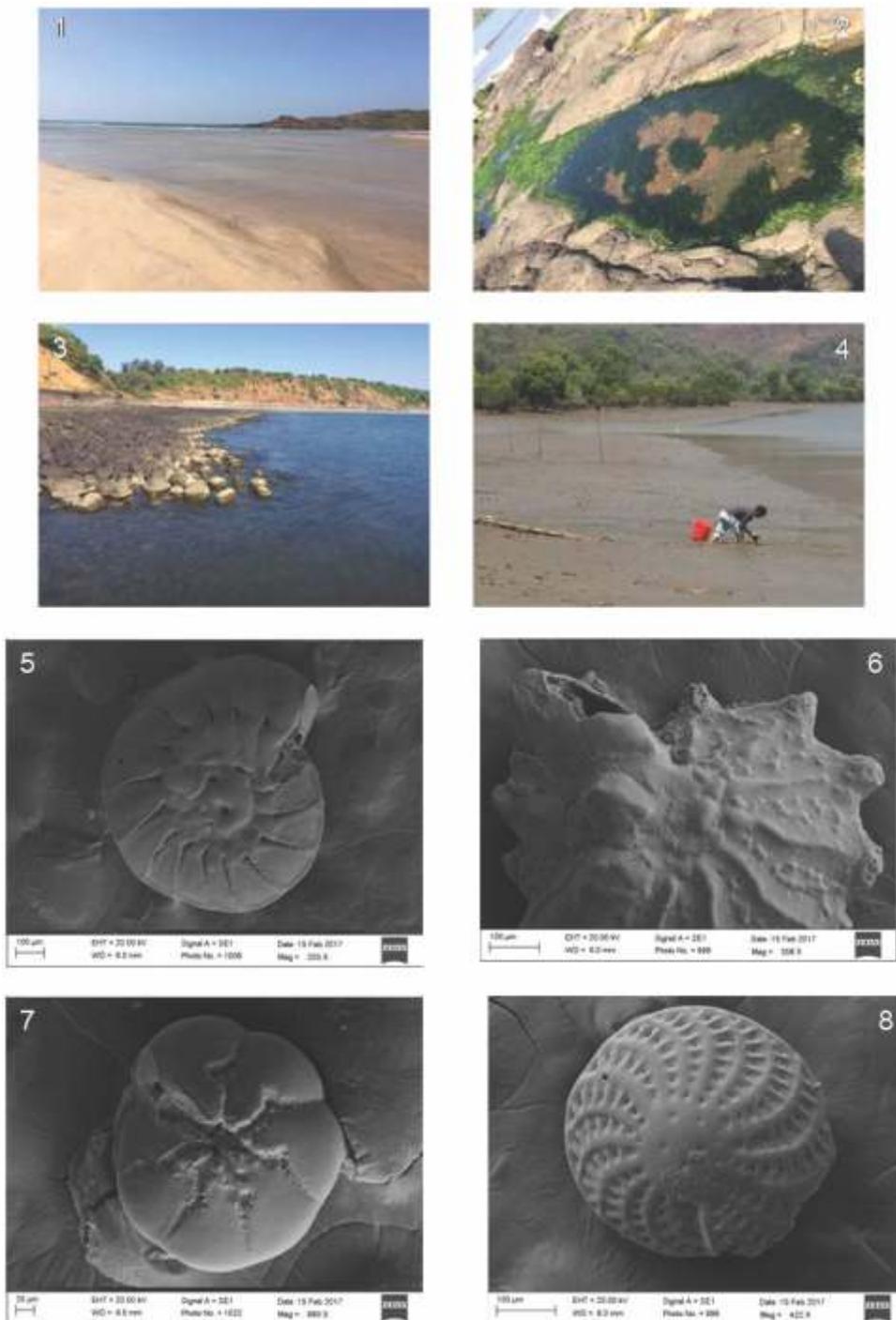


Figure 19

Variety of coastal marine environments explored during present study

1. Sandy coast; 2. seaweed exposed during low tides; 3. Algae attached to submerged rocks; 4. mud flats; and associated foraminiferal diversity (5- *Rotalidium annectens*; 6- *Calcarina calar*; 7- *Ammonia tepida*; 8- *Elphidium crispum*)

Bioenergy Group

Scientists



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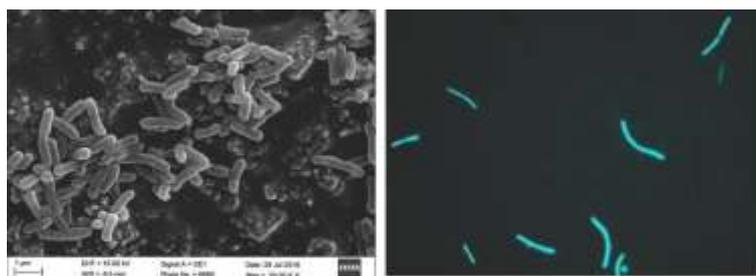
Mr Pranav R Kshirsagar

BIOENERGY

Exploring microorganisms for industrial applications especially in petroleum biotechnology and bioenergy is the major emphasis of research in Bioenergy. Microbes isolated from the extreme/ pristine environment have been explored for biomethanation of lignite, enhanced oil recovery from high temperature depleted oil reservoirs, and bioremediation of terrestrial oil spills.

Biomethanation of lignite

Lignite is a soft brownish low ranked coal that is an intermediate between bituminous coal and peat. It shows traces of plant structure especially the recalcitrant part lignin. Lignite is not a preferred source of fuel because of its low energy density, high moisture content and high emission of CO₂. One of the ways to extract energy from lignite is to in situ convert lignite into methane. A microbial consortium comprising of hydrolytic bacteria, acetogens and methanogens was developed for the biomethanation of lignite (Figure 20). This consortium under un-optimized conditions was able to produce methane from lignite at an efficiency of 80-95 ml of biogas per gram of lignite with methane concentration of 26-52 %.



Hydrolytic bacteria
SEM image – Magnification 20K x

Methanogenic isolate
Fluorescent Microscopy image



Microbial consortium for biomethanation of Lignite
SEM image – Magnification 22K x

extract energy from lignite is to in situ convert lignite into methane. A microbial consortium comprising of hydrolytic bacteria, acetogens and methanogens was developed for the biomethanation of lignite (Figure 20). This consortium under un-optimized conditions was able to produce methane from lignite at an efficiency of 80-95 ml of biogas per gram of lignite with methane concentration of 26-52 %.

Figure 20

Microscopy images for hydrolytic bacteria, methanogens and consortium developed for biomethanation of lignite

biomethanation efficiency of 20.8 to 44.2 ml/ g or L/kg within 14 days at 55° C. Lignite degradation under optimized growth conditions (pH, temperature, salinity and oxygen requirement) revealed TPH degradation efficiency of 98 %.

Microbial Enhanced Oil Recovery (MEOR)

A microbial consortium of hyperthermophilic bacteria growing optimally at >96°C was developed. This consortium was characterized by its ability to produce metabolites such as biosurfactants/ bioemulsifiers, organic acids, volatile fatty acids, solvents, exopolysaccharides and CO₂. These metabolites were desired to enhance oil recovery from depleted oil reservoirs. The microbial consortium was found to be nontoxic/ nonpathogenic. A customized nutrient medium was developed to support luxuriant growth and desired metabolite production under the conditions simulating harsh reservoir environment. The microbial consortium enhanced 11.8 % and 27.4 % oil recovery at 96°C and 101°C respectively in sand packed experiments simulating the reservoir conditions (Figure 21). These results highlight the potential microbial consortium as a promising candidate for MEOR at temperatures 96–101°C.

Figure 21

Sand pack study simulating reservoir conditions



Bioremediation of terrestrial oil spills

A time and cost effective microbial process was developed for remediation of petroleum contaminated sites. It is believed that use of powdered microbial formulations can be an ideal strategy for effective in situ bioremediation of contaminated sites. A microbial consortium was developed to efficiently degrade petroleum hydrocarbons associated with terrestrial oil spills. Microbial consortium exhibited hydrocarbon degradation efficiency of ~70 % in oil contaminated soil within 14 days. After RSM optimization and addition of bulking agent such as saw dust TPH degradation efficiency of the consortia was further improved up to 88 % in 14 days of incubation. Change in soil appearance (Figure 22) and peak area of chromatogram confirmed the bioremediation efficiency of the developed microbial consortia.



Figure 22

The change in the color and texture of the soil can be observed after remediation

bioprospecting
Group
Scientists

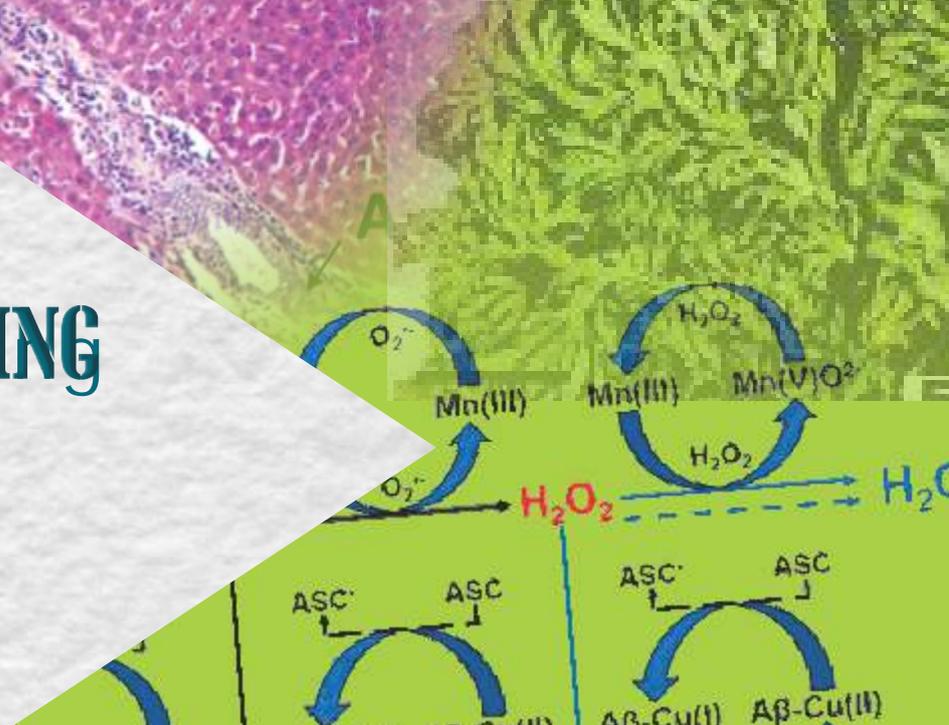


Dr Prasad P Kulkarni



Dr Pratibha Srivastava

BIOPROSPECTING



Bioprospecting is the process of discovery and commercialization of new products based on biological resources. The primary focus of research is the isolation and synthesis of naturally occurring compounds, derivatives and their use in pharmaceuticals, nutraceuticals, agriculture and industries. Deciphering the mechanistic approach of these compounds for disorders such as Alzheimer's disease, anemia, diabetes, cancer, and chikungunya virus is also underway.

Lichen metabolites

Natural products with diverse bioactivities are a major source of novel chemicals. Pharmaceutical industries conduct research and development of new pharmacologically active molecules. Similar to higher plants, lichens are also considered as potential source of novel biologically active compounds.

With this aim, the research is to explore some of the biological activities of the lichen species of genus *Heterodermia* (Figure 23). Antilipoxygenase, radical scavenging and antimicrobial activity of the lichen species are selected. The ethyl acetate extract of the species has shown concentration dependent lipoxygenase (LOX) inhibition. Fifty percent (IC_{50}) LOX inhibition was obtained by *H. diademata*, *H. flabellata*, *H.*

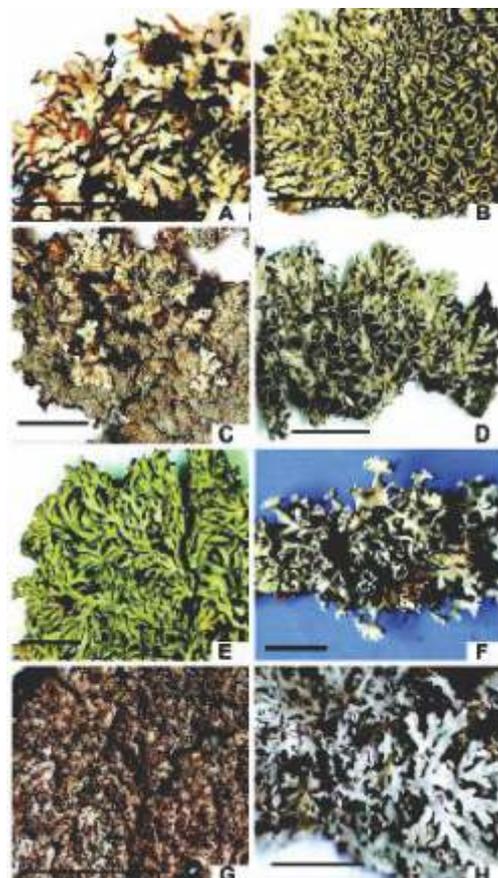


Figure 23

Natural thalli of lichens: A: *Heterodermia albicans*, B: *H. angustiloba*, C: *H. antillarum*, D: *H. diademata*, E: *H. flabellata*, F: *H. incana*, G: *H. isidiophora*, H: *H. pseudospeciosa* (scale = 10 mm)

antillarum and *H. incana* with 0.123, 0.153, 0.160, 0.150 mg/ml respectively; which is smaller than the synthetic antioxidant BHA and BHT. Only the extract of *H. diademata* showed IC_{50} 0.123 mg/ml is equal to LOX inhibitor Indomethacin. The LOX inhibition kinetics of the lichen extract showed a different mode of inhibition. Competitive inhibition was found towards LOX by *H. albicans*, *H. antillarum*; uncompetitive inhibition by *H. diademata* and noncompetitive inhibition demonstrated by *H. angustiloba*, *H. flabellata*, *H. incana*, *H. isidiophora* and *H. pseudospeciosa*. These species extract have also shown $\leq 50\%$ radical scavenging activity. The ethyl acetate extract of *H. diademata*, *H. angustiloba*, *H. albicans* and *H. isidiophora* showed the strong antimicrobial activity against most of the tested microorganisms namely, *Bacillus subtilis* (NCIM2063), *Streptococcus faecalis* (NCIM5024), *Candida albicans* (NCIM3471) and *Cryptococcus albidus* var. *diffluens* (NCIM3371) at concentration ranging from 0.232 mg/ml to 0.591 mg/ml.

Findings suggest that lichen species of genus *Heterodermia* can be used as new bioresources for the natural lipoxygenase inhibitor with antimicrobial and radical scavenging features.

Mn(III)-(N,N -Ethylenebis(salicylimine)) or Mn(III)-salen protects against different reactive oxygen species generated by A β 16-copper complex

Alzheimer's disease (AD) is the most common form of dementia. The brain of AD patients contains extracellular amyloid plaques which is a hallmark of the disease. The abnormal proteolytic cleavage of amyloid precursor protein by β - and γ - secretase forms extracellular amyloid beta (A β) peptide. A β -Cu complex generates different reactive oxygen species (ROS) which are responsible for oxidative stress in neuronal cells. We studied the effect of Mn(III)-salen on A β -Cu catalyzed ROS generation using different assays. Mn(III)-salen reacts with superoxide radicals ($O_2^{\cdot-}$) generated by A β -Cu and delays H_2O_2 production. Mn(III)-salen significantly inhibits the formation of hydroxyl radicals (HO \cdot) produced by A β -Cu which is further confirmed using mass spectrometry analysis. Our study reports that Mn(III)-salen protects against different ROS produced by A β 16-Cu. H_2O_2 produced by A β 16-Cu activates Mn(III)-salen to oxomanganese complex which further detoxifies NO production in microglial cells (Figure 24). The antioxidant properties of Mn(III)-salen can be useful for in vivo applications.

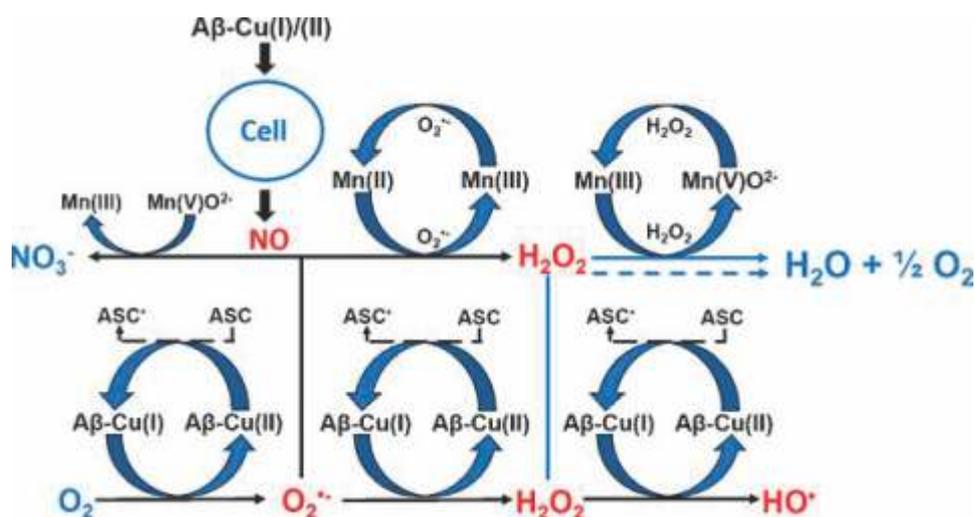


Figure 24

Mn(III)-salen protects against different ROS species generated by A β 16-Cu complex

Nutraceuticals for the treatment of inflammation associated anemia

Inflammation associated anemia (AI) is the second most prevalent anemia after iron deficiency anemia. A variety of conditions including infections, cancer and autoimmune conditions can lead to AI. Hepcidin is a key molecule, which regulates the iron metabolism in the body and plays an important role in AI. Earlier we established the method for measurement of iron distribution in Caco-2 and RAW-264.7 cells using fluorescent probes. We studied the in vivo efficacy of *Guduchi* (*Tinospora cordifolia*) extract in an animal model of AI. AI was induced in Wistar Rats using heat killed *Brucella abortus* + Complete Freund's Adjuvant. Animals were divided into four groups as follows: inflammatory control (IC) and at three groups with different doses of *Guduchi* extract viz. 100 mg/kg of body weight, 200 mg/kg of body weight, 400 mg/kg of body weight. The animals were pretreated with respective doses of *Guduchi* extract for two weeks. At the end of 2nd week, AI was induced and treatment with *Guduchi* extract was continued for next two weeks to the respective groups. *Guduchi* extract showed significant improvement in hemoglobin (Hb) levels and total red blood cell (RBC) levels at 3rd and 4th week as compared to IC group. Liver histological analysis showed dilation of the bile duct and increase in infiltration of inflammatory cells in IC rats as compared to *Guduchi* treated rats (Figure 25). Similarly, spleen histology analysis also showed increased hemosiderosis and necrotic white patches in IC rats as compared to *Guduchi* treated rats indicating a significant improvement in AI associated toxicity upon *Guduchi* extract treatment (Figure 25).

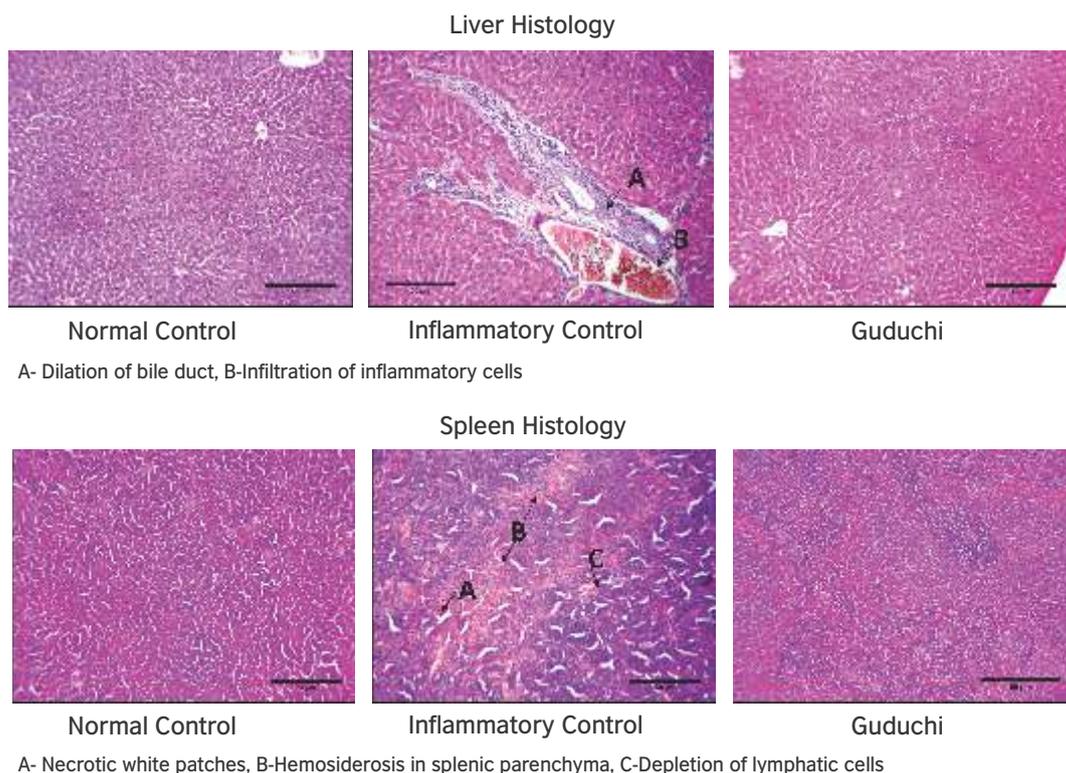


Figure 25

Effect of *Guduchi* extract (400 mg/ kg body weight) on liver and spleen histology. Values expressed in mean \pm SEM, * $p < 0.05$

Development of smartphone based application (app) for hemoglobin estimation

Hemoglobin is the most commonly used indicator for assessing anemia. Conventional methods used for Hb estimation have several limitations including sensitivity and cost of analysis. Smartphone based methods could provide a better alternative to currently available methods for estimation of Hb. We developed an Android system based smartphone app called "Hb Calculator" for accurate and sensitive measurement of Hb (Figure 26). We measured Hb values of 82 blood samples using developed app and compared with Hb values by an automated hematology analyzer. The linear least-squares regression analysis showed a significant correlation ($R^2=0.976$) between the values obtained from the automated hematology analyzer and those measured using the developed app. A Bland–Altman analysis showed that the standard deviation of the difference between the Hb measured by the two methods was 0.35 g/dL and the limits of agreement between the two approaches were -0.62 to 0.75. The higher sensitivity, specificity, accuracy and reliability of the smartphone app for the Hb measurements makes it an attractive alternative for Hb estimation in resource-limiting conditions.



Figure 26

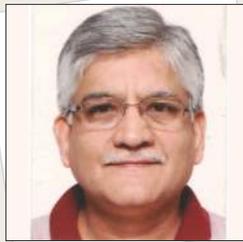
Screen-capture of the “Hb calculator” smartphone app running on an Android operating system, detailing the workflow of the app. Upon clicking the Hb calculator app icon (a) the splash screen is launched (b). Initially, an image of the well-containing solution blank is captured and set as the calibration image (c and d). After this, an image of the well-containing sample solution is captured and analyzed (e and f). The app automatically calculates the Hb value (g/dL) for the respective sample and the result is displayed on the screen (g)

Synthesis of bioactive molecules

Target natural molecule is a Homoisoflavanone (\pm)-5,7-dihydroxy-8-methyl-3-(2',4'-dihydroxybenzyl)chroman-4-one (1). This molecule has been found in Gan Luo Xin pill which is a traditional Chinese medical formula composed of 20 kinds of herbs. It has potential towards anti-inflammatory and immunomodulatory activity. Homoisoflavanones are known for various pharmacological properties. Therefore, we have selected this compound. We have planned the synthesis of Homoisoflavanone 1. Based on literature survey we have decided the retrosynthetic pathway of these molecules, which consist of 6 steps. Acylation, methylation, and chalcone formation followed by reduction using hydrogen with palladium-charcoal was carried out. Up to five steps synthesis is completed and the intermediates were characterized by IR spectroscopy, mass spectrometry and NMR analysis. Remaining two steps are also done but they are under characterization. Various derivatives are under process by using different aldehydes in the step 3. These compounds will be tested for various pharmacological activities.

Previously rugosaf flavonoid and communitin derivatives have been synthesized and evaluated for antiviral activity against Chikungunya virus. They showed promising results. These compounds also showed cytotoxicity activity against MCF-7 but they are not cytotoxic for normal fibroblast cell lines NIH3T3. EGFR expresses in most of the tumor, therefore, docking analysis with 1M17 has been carried out.

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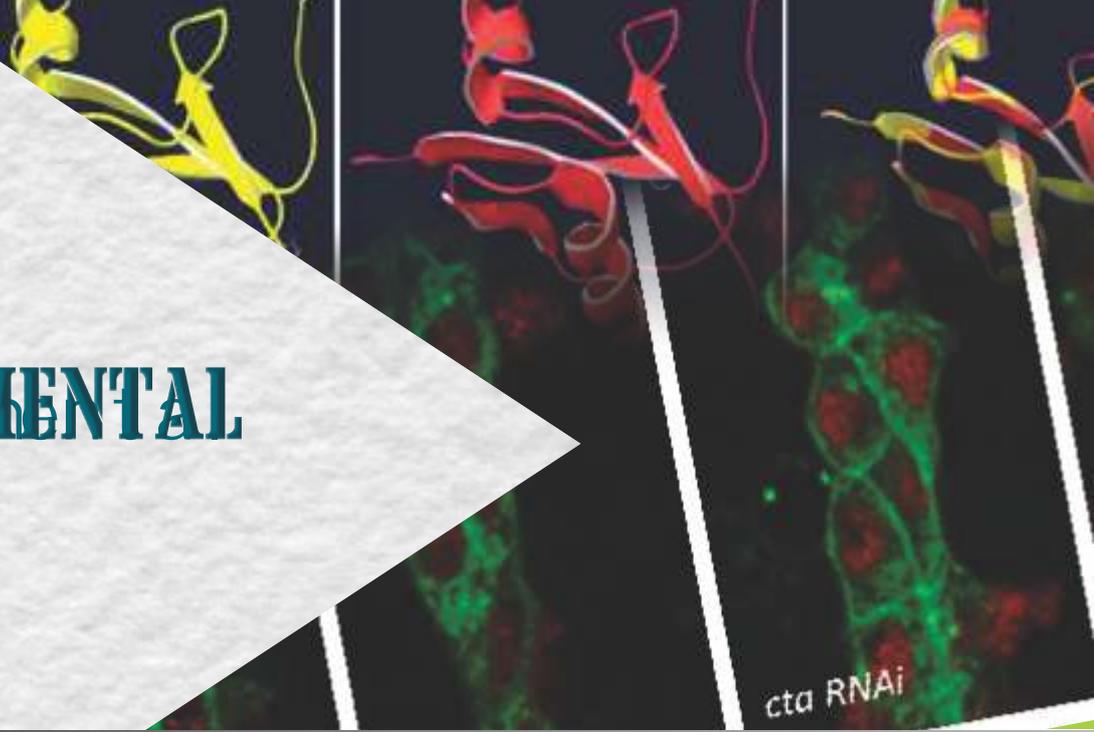


Dr Chinmoy Patra



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DEVELOPMENTAL BIOLOGY



Diploblastic cnidarian Hydra, insect model Drosophila and a chordate zebrafish are being used as model organisms to study different processes involved in animal development.

Hydra

Role of autophagy during regeneration

Autophagy is an evolutionarily conserved process in eukaryotic cells that is involved in degradation of cytoplasmic contents including organelles via the lysosome. We study the role of autophagy during regeneration in Hydra. Hydra is an early metazoan which exhibits simple tissue grade organization, a primitive nervous system, and is one of the classical non-bilaterian models extensively used in evo-devo research. Here we describe the characterization of two core autophagy genes, *Atg12* (Figure 27 A,B) and *Atg5* (Figure 28 A,B), from the hydra. *In silico* analyses including sequence similarity, domain analysis, and phylogenetic analysis demonstrate the conservation of these genes across eukaryotes. The predicted 3D structure of Hydra *Atg12* showed minimal variance when compared to human *Atg12* and yeast *Atg12* (Figure 27C) while hydra *Atg5* predicted 3D structure was found to be variable as compared to its human and yeast homologs (Figure 28C). Strikingly, the whole mount in situ hybridization showed high expression of *Atg12* transcripts specifically in nematoblasts (Figure 27D) whereas *Atg5* transcripts were found to be expressed strongly in the budding region and growing buds (Figure 28D). This study may provide a framework to understand the evolution of autophagy network in higher eukaryotes.

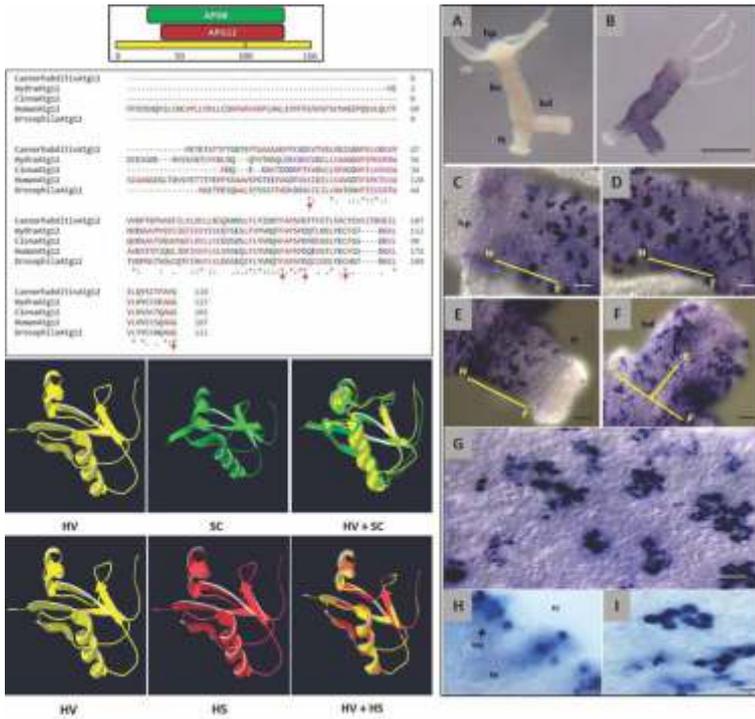


Figure 27

Characterization of HyAtg12 of hydra

A. SMART analyses of the HyAtg12 protein show characteristic APG12 domain. B. MSA of complete HyAtg12 protein with corresponding animal orthologs show conservation of amino acid residues. Arrows indicate important residues for Atg12-Atg5 interactions and complex formation. (*) indicates position with single fully conserved residue, (:) indicates conservation between groups of strongly similar properties and (.) indicates conservation between groups of weakly similar properties. C. Tertiary structures of Atg12 of the hydra, human and yeast simulated from available solved structures using Swiss Model Tool. D. Whole mount *in situ* hybridization with *Atg12* antisense riboprobe which shows the expression of

Atg12 in a whole polyp, hypostomal region, body column, foot region and bud of the hydra, respectively. Expression of *Atg12* can be seen in clusters of nematoblasts and epithelial cells of ectoderm of body column. *Atg12* is very strongly expressed in ectodermal nematoblast cells and lower level of expression in endodermal epithelial cells

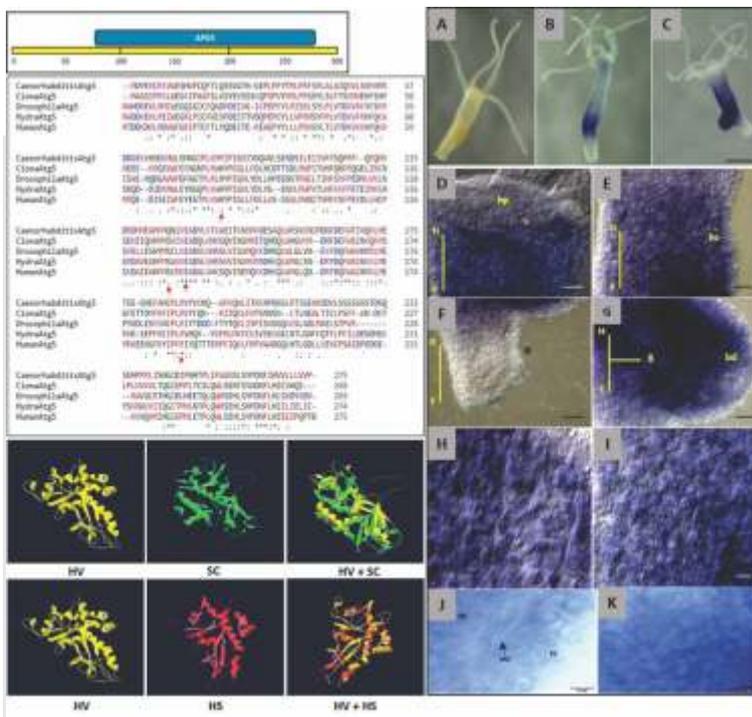


Figure 28

Characterization of HyAtg5 of hydra

A. SMART analyses of HyAtg5 protein show characteristic APG5 domain. B. MSA of complete HyAtg5 protein with corresponding animal orthologs shows conservation of amino acid residues. Arrows indicate 23 important residues for Atg12-Atg5 interactions and complex formation. (*) indicates position with single fully conserved residue, (:) indicates conservation between groups of strongly similar properties and (.) indicates conservation between groups of weakly similar properties. C. Tertiary structures of Atg5 of the hydra, human and yeast simulated from available solved structures using Swiss Model Tool. D. Expression of *Atg5* in body column of non-

budding polyp and in budding polyp and the growing bud. Magnified views show expression of *Atg5* in hypostomal region, body column, foot region and bud of the hydra, respectively. *Atg5* is strongly expressed in budding region of Hydra polyp and growing bud and both ectodermal and endodermal cells

Drosophila

Determining the role of autophagy in stem cell maintenance and its regulation during nutrient stress

To understand the regulation of autophagy in stress conditions and to study its role in stem cell maintenance we employ *Drosophila melanogaster* as a model. An evolutionarily conserved role of autophagy is to promote cell survival in conditions of stress including nutrient stress. Amino acid starvation leads to transcriptional upregulation of several autophagy genes. We have analyzed a series of *Atg8a* promoter deletions that drive expression of mCherry-*Atg8a* fusion protein to identify cis-regulatory modules. Expression analyses revealed that a 200bp 5'UTR region of the promoter is sufficient to drive expression of *Atg8a* in both nutrient-rich and nutrient-deficient conditions. *In-silico* studies have uncovered several known and putative transcription factors that regulate *Atg8a* expression. These have been identified and are currently being tested.

Like most stem cells, germline stem cells are also subject to cellular damage that causes premature aging and render them inactive leading to their depletion within the gonads. Macro-autophagy (autophagy) helps prevent premature aging by removing of toxic material from the cells. We are investigating the role of autophagy in maintenance, differentiation and aging of female germline stem cells (GSCs) of *Drosophila*.

Drosophila as a model system to study development of the nervous system

The nervous system is made up of two cell types: neurons and glia. The latter plays a significant role in the

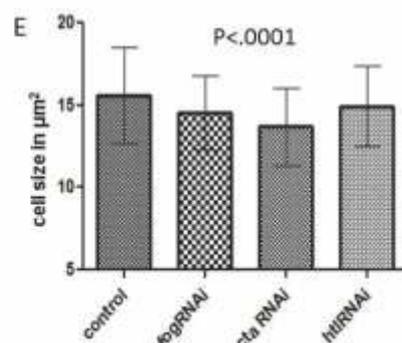
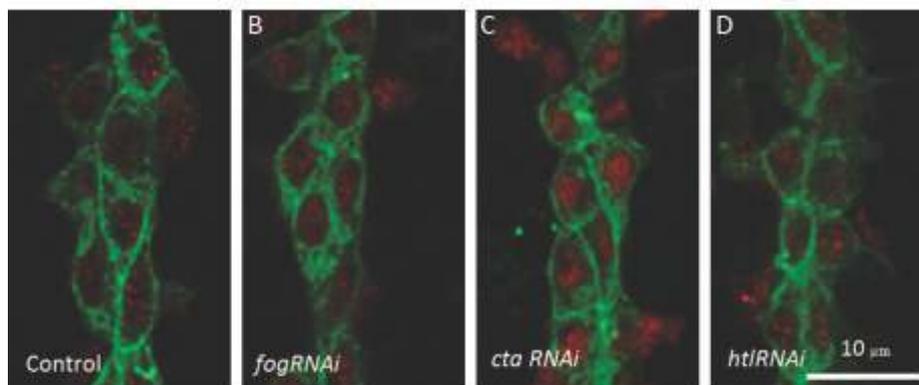


Figure 29

Knock-down of *fog* and *fgfr/heartless* leads to decrease in glial size

A) Control glia. B) Knock-down of *fog* leads to small and more tightly packed glia. Knock-down of the G-protein concertina (C) and heartless (D) also affects glial size. (E) Graph showing the average glial size

development and maintenance of the nervous system. It is well known that glia secrete attractive and repulsive cues to help axonal growth cones navigate and reach their targets; they ensheath neuronal cell bodies, axons and synapses to protect them from ionic imbalances and other toxic insults. In *Drosophila*, the interface or longitudinal glia (LG) ensheath the underlying neuropil in the embryonic CNS. FGF signaling mediated by the receptor Heartless (Htl), and the GPCR signaling pathway activated by Folded gastrulation (Fog), are known to regulate morphology of these glia (Figure 29). We have been carrying out genetic studies to test if these two signaling pathways interact in the CNS, and the mechanism involved.

Like vertebrates, multiple types of glia are present in *Drosophila*. To understand glial diversity we have started by trying to identify enhancers that drive expression in different glial subsets. To begin, we have chosen enhancers from a set of glial specific genes with known patterns of expression in the CNS. It is hoped that identification of these enhancers and their regulators will allow us to address questions related to glial diversity.

Zebrafish

Distribution of cECs in adult mouse and zebrafish ventricles

Several works suggest that connective tissue growth factor (CTGF) plays an important role during organ development and regeneration via regulating the growth factors or cell membrane receptors activity as well as interacting with other ECM components. In the present study, zebrafish was chosen as a model organism to explore the loss-of-function of CTGF during zebrafish development. Our collaborative work study with Dr. Kenneth D. Poss, Duke University, USA uncovers that CTGF is necessary to stimulate spinal cord regeneration via glial bridging.

Despite our increasing understanding of zebrafish heart development and regeneration, there is limited information about the distribution of endothelial cells (ECs) in the adult zebrafish heart. Here, we investigate and compare the distribution of cardiac ECs (cECs) in adult mouse and zebrafish ventricles. Surprisingly, we find that (i) active coronary vessel growth is present in adult zebrafish, (ii) ~37 and ~39% of cells in the zebrafish heart are ECs and cardiomyocytes, respectively, a composition similar to that seen in the mouse. However, we find that in zebrafish, ~36% of the ventricular tissue is covered with ECs, i.e., a substantially larger proportion than in mouse. Capitalizing on the high abundance of cECs in zebrafish, we established a protocol to isolate them with high purity using fluorescent transgenic lines (Figure 30). Our approach eliminates side-effects due to antibody utilization. Moreover, the isolated cECs maintained a high proliferation index even after three passages and were amenable to pharmacological treatments to study cEC migration *in vitro*. Such primary cultures will be a useful tool for additional *in vitro* studies on the accumulating zebrafish mutant lines as well as the screening of small molecule libraries on cardiac specific endothelial cells.

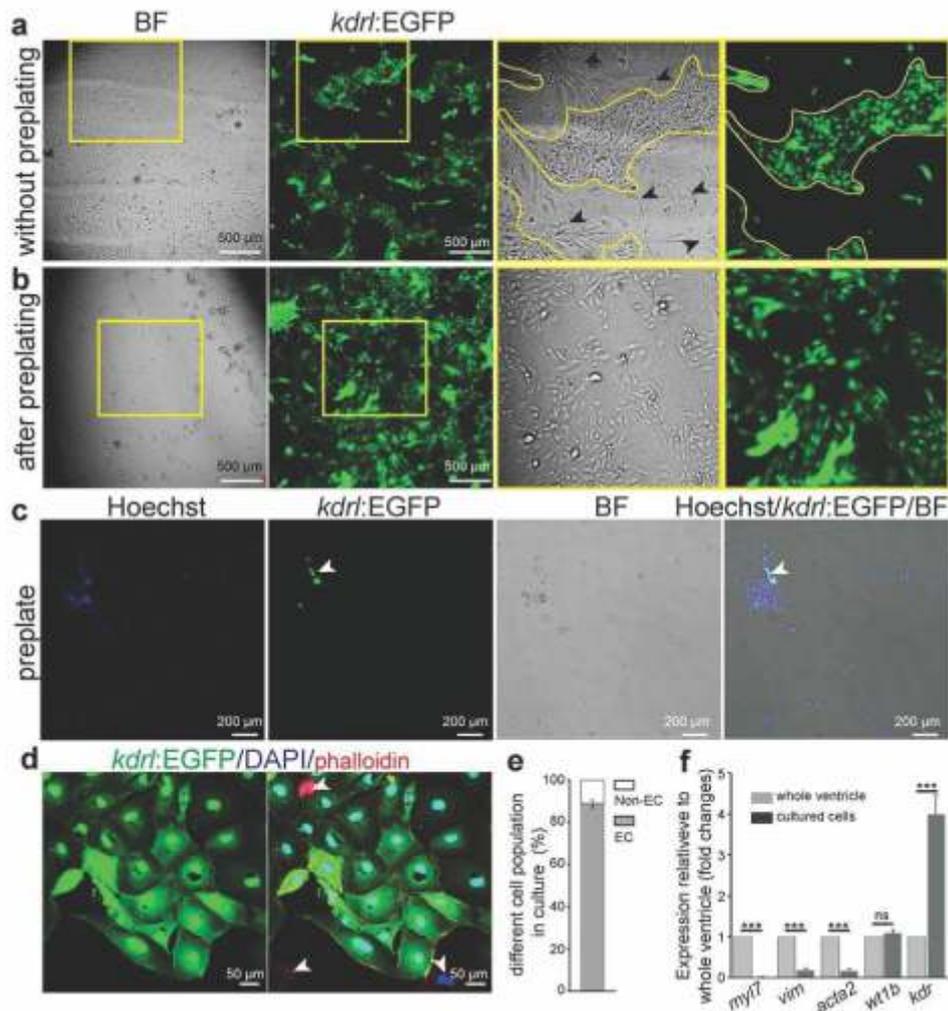
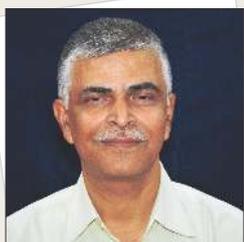


Figure 30
Culture of ventricular endothelial cells isolated from adult *Tg(kdr:EGFP)* zebrafish

(a-b) Brightfield and fluorescence images of cultured cells (60 h after seeding) on a fibronectin coated culture dish without a pre-plating step (a) or after a four h preplating step (b). Black arrowheads, non-endothelial cells; BF- Brightfield. (c) An example of brightfield and fluorescence images (green for EGFP positive endothelial cells, and blue for nuclei (Hoechst 33342)) of isolated live ventricular cells on the preplate, after four h preplating. (d) An example of cultured cardiac endothelial cells after 1st passage, stained for EGFP (green), rhodamine phalloidin (all cell types, red), and DAPI (nuclei, blue). (e) Quantification of endothelial cells to total cells after 1st passage, showing the high purity of the cultures. (n=3, mean±SEM). (f) RT-qPCR analysis using cardiomyocyte (*myl7*), fibroblast (*vim*), smooth muscle cell (*acta2*), epicardial (*wt1b*), and endothelial (*kdr*) markers (n=3, mean±SEM). Marker gene mRNA expression levels relative to *α-tubulin* were calculated using the ΔCt method. The expression is relative to the individual marker's expression in whole cardiac ventricles. All non-endothelial markers, besides *wt1b*, are depleted in the isolated cell population. Concomitantly, the isolated cells show enrichment for the endothelial marker *kdr*. One way ANOVA followed by Bonferroni's post-hoc test (GraphPad Prism) was performed to evaluate the statistical significance of differences. $P < 0.05$ was considered statistically significant. *** corresponds to $P < 0.001$.

Genetics and Plant Breeding Group Scientists



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GENETICS AND PLANT BREEDING

ARI is a leading center for improvement of crops such as wheat, soybean and grapes under the All India Coordinated Research Projects funded by Indian Council of Agricultural Research, New Delhi.

Crop Biotechnology

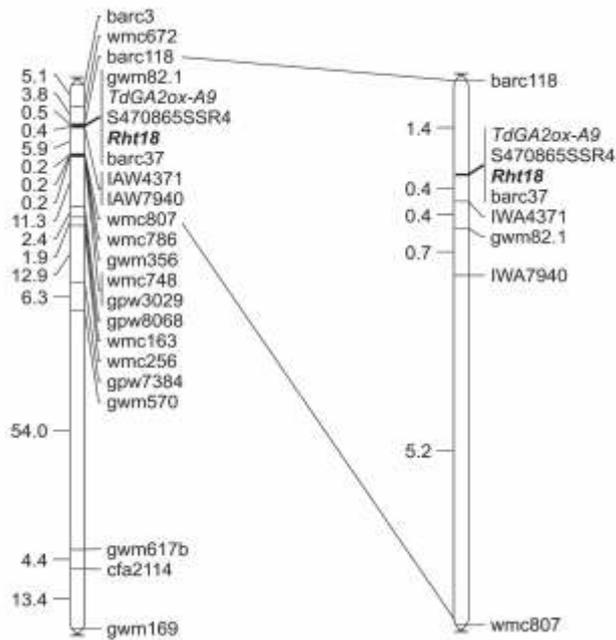
Marker assisted breeding

Marker assisted breeding was undertaken for the improvement of grain protein content and gluten strength in the popular bread wheat varieties NI 5439 and MACS 2496 of the peninsular region and grain protein and yellow pigment content in the durum wheat varieties MACS 3125 and HI 8498. Based on three years replicated trial data, promising lines for all the targeted traits have been identified. Three promising lines each for high grain protein content and yellow pigment content in the background of durum variety MACS 3125 were included in Initial Plant Pathological Screening Nursery (IPPSN) during *rabi* season of 2015-16 for disease resistance screening. All the lines showed resistance to all the three rusts and leaf blight in Initial Plant Pathological Screening Nursery (IPPSN). One promising line each for high grain protein content and yellow pigment content in the background of durum variety HI 8498 have been included in (IPPSN) during *rabi* season of 2016-17 for disease resistance screening.

The replacement of short arm of the wheat 1B chromosome by short arm of rye 1R chromosome (1BL/1RS translocation) has been widely used around the world to enhance wheat yield potential, resistance to rust and mildew and adaptation. Many popular Indian varieties also contain this translocation. The translocation is however, associated with inherent quality problems like reduced dough strength and dough stickiness. To overcome sticky dough problem of 1BL/1RS (*Glu-B3*/*Sec-1*⁺), removal of monomeric secalins and addition of polymeric glutenins by introgression of new 1BL/1RS (*Glu-B3*⁺/*Sec-1*) translocation using marker assisted backcross breeding approach is underway.

Mapping of GA-sensitive dwarfing genes in durum wheat

Gibberellin-sensitive dwarfing gene *Rht18* was mapped within a genetic interval of 1.8 cM on chromosome 6A in durum wheat (Figure 31). A new microsatellite marker S470865SSR4 with trinucleotide repeat (GTA)_n was identified for selection of *Rht18*. The marker was validated by assessing



its allelic frequency in 89 diverse durum and bread wheat accessions. It was observed that 204 bp allele of S470865SSR4 could differentiate Icaro from rest of the wheat accessions except HI 8498, suggesting its utility for selection of *Rht18* in wheat improvement programmes. New SNP markers (*TdGA2ox-A9*, *IAW4371* and *IAW7940*) were also developed for selection of *Rht18*.

Figure 31

Genetic linkage map of chromosome 6A showing SSR and SNP markers linked to *Rht18* in Bijaga Yellow/Icaro population

Mapping QTL/genes for resistance to spot blotch in durum wheat

Spot blotch caused by *Bipolaris sorokiniana* (Sacc.) Shoem is a major biotic stress to wheat in India causing up to 100% yield loss under severe disease conditions. Breeding for resistance to spot blotch provides an economical and eco-friendly strategy to manage the disease. However, information on the genetics of spot blotch resistance is inadequate particularly in durum wheat. QTL mapping for spot blotch resistance is therefore undertaken in the RIL population developed from a cross of Bijaga yellow (Susceptible) × MACS 3125 (Resistant). In marker analysis, total 1007 markers were tested for polymorphism. RIL population was genotyped using 108 markers. Four putative QTL for spot blotch resistance in durum wheat have been identified on chromosomes 1BL, 2BL and 3AS.

Wheat Improvement

Wheat variety notified

MACS 3949 (Figure 32) durum wheat variety has been notified in the 76th meeting of ICAR Central Sub-committee on Crop Standards, Notification and Release of Varieties for Agricultural Crops. The variety was identified based on its higher yield potential than the latest check, better disease resistance and pasta quality under timely sown, irrigated condition of Peninsular Zone. Under the coordinated trial, MACS 3949 was found to be significantly superior to latest check variety UAS4 28(d). This variety had an average yield 46.23 q/h. It was resistant to black and brown rust, had better nutritional quality (protein 12.9%, zinc 40.6ppm, iron 38.6 ppm) with good milling quality and highest pasta score of 7.25 (out of 9) with bold grain 47.0g (1000 g wt).



Figure 32

MACS 3949

Promising wheat entries

AVT Final Year Entry

Wheat entry MACS 4028 (*Triticum durum*) is in its final year testing under rainfed timely sown condition in Peninsular Zone. This entry was significantly superior over best check with yield gain of 25.82 % in NIVT 5B and 18.93 % in AVT 1st year. It has better nutritional quality protein 14.5%, zinc and iron 41.0 ppm each.

AVT First Year Entry

Similarly, wheat entry MACS 6677 (*Triticum aestivum*) has been promoted in the first-year AVT under restricted irrigated conditions in North Western Plane Zone. This entry was significantly superior over best check DBW 110 and yield gain was 6.69%. This entry shows height 102 cm (86-114), days to flowering 77 days and maturity 120 days (110-120). This entry was resistant to leaf rust and yellow rust at NWPZ.

Multilocational germplasm evaluation under consortium research programme (CRP) in agrobiodiversity

544 cultures were evaluated under Consortium Research Programme (CRP) in Agrobiodiversity. Pathological observations were recorded for stem rust and leaf rust. A total of 43 cultures were resistant and 116 moderately resistant to black rust, while 34 were resistant and 19 were somewhat resistant to brown rust. Overall, 15 cultures were resistant to both leaf and stem rusts.

Wheat front line demonstrations

Front Line Demonstrations (FLD) are organized every year with the support of central Ministry of Agriculture to popularize new wheat production technologies and varieties. During 2015-16 crop season, ten FLDs have been conducted at Hol and Songaon, taluka Baramati, district Pune which includes MACS 6478 (*aestivum*) and Hw1098 (*dicoccum*) as new improved varieties against popular checks RAJ4037, Hd2189 and DDK1029. The new improved technology increased yield by 17% over checks indicating that this new varieties/technologies can provide a greater jump in wheat yield levels of Maharashtra State.

Breeder seed programme

During 2016-17 season 150 quintals of breeder seed of varieties MACS 6478, MACS 6222, MACS 2971, MACS 3125 was supplied to different seed multiplying agencies and farmers. For the current season expected breeder seed production is 240 q.

Public Private Partnership (PPP)/ Technology transfer

Choupal Pradarshan Khets: For rapid dissemination of technologies and smooth flow of seed supply to industry Public Private Partnership (PPP) was renewed for next two year under the umbrella of Indian Tobacco Company (ITC). Thirty wheat Choupal Pradarshan Khets (CPK) were conducted in Ahmednagar, Amravati, Wardha and Yavatmal districts of Maharashtra. Of these, 15 CPKs were of new improved varieties MACS 6222 and MACS 6478 and the remaining 15 were of popular checks GW-496, Lok-1, HD 2189, Ajit-102, Kedar and Green Baba. The improved varieties showed superior performance over check varieties in all respects and performed well even under 2-3 irrigations. These demonstrations showed that farmers could get a yield of 35-36 q/ha.

Exploiting wheat alien introgressions for increased photosynthetic productivity in contrasting environmental conditions under nitrogen treatments (BBSRC)

Thinopyrum bessarbicum based wheat introgressed lines were crossed to the adopted varieties of our zone (PZ), few of them led to fertile seeds. These F1 seeds would be further selfed or back crossed to develop genotypes with agronomically improved traits. From a population of 30 Indian test genotypes few interesting varieties like DBW71, HD2932 and NW1067 showed higher photosynthetic capacity. Genotypes BH1146 and CBW 38 exhibited high tillers per metre, biomass seemed to be more in HD 2932 and NW 1067, whereas fluoropen readings indicated Kharchia 65 and K 307 as stress tolerant genotypes. Varieties KR 213 and DBW 51 showed lower Canopy temperature value. In another set of experiments including amphidiploids, the introgression lines like EC 787009, EC 78007 showed lower Canopy temperature value whereas, SPAD values were found to be highest in EC 787012. Check varieties Paragon and HD 2967 were found to be more stress tolerant than introgression lines.

Soybean Improvement

Yield performance of MACS soybean varieties

One soybean variety developed at MACS-ARI, viz. MACS 1460 showed the best yield performance in Eastern Zone and North Eastern Hill Zone in Advanced Varietal Trial-II (AVT-II - the final year testing of All India Coordinated trials). MACS 1460 gave the highest average yield of 1813 kg/ha and ranked first in Eastern Zone. In North Eastern Hill Zone it ranked second with an average yield of 1580 kg/ha. MACS 1460 was earliest to mature (92 days). In Southern Zone during the final year of testing MACS 1460 gave an average yield of 2430 kg/ha and was the earliest maturing (89 days) variety in the zone.

Based on yield, over three years of testing and resistance against major insects and diseases MACS 1407 variety was identified for release in North Eastern Zone of India. This variety gave 17% increase in yield over the best check. It showed resistance against YMV and Pod Blight diseases. It is also resistant to pests like Girdle Beetle and Stem Fly. This has been identified for cultivation in the states of Assam, West Bengal, Jharkhand, Chhattisgarh and North Eastern states.

Evaluation in All India coordinated soybean trials

In the yield evaluation trials carried out at ARI, MACS 1460, performed significantly better than the highest yielding check variety – RKS 18. MACS 1460 (87 days) was also the earliest maturing variety in the trial. In the Initial Varietal Trial (IVT) conducted at Hol Farm MACS 1520 gave a significantly highest yield of 3812 kg/ha.

Station trials for soybean improvement

Eighty-two elite breeding lines were developed and tested in three graded replicated trials. Of these, three lines gave significantly more yield than the highest yielding control variety MACS 1188 and four lines gave considerably more yield than the earliest maturing check variety JS 93-05.

Agronomy research in soybean

In sowing dates experiment, average seed yield of 5 AVT-II varieties tested was significantly higher by 22% when the sowing was done at regular sowing date compared to late sowing. In tillage and crop diversification trial differences for tillage was a non-significant while in the Soybean-Maize-Soybean-Maize system the yield (4509 kg/ha) was significantly higher over the rest of the cropping systems. In

foliar nutrition trial, treatment with recommended fertilizer dose (RDF) supplemented with a foliar spray of 2% Urea at pod initiation stage (2838 kg/ha) enhanced the seed yield by 12% over RDF only (2532 kg/ha).

Resistance of MACS varieties to diseases and pests

Soybean variety MACS 1370 developed by ARI was identified as a donor for resistance against leaf minor and stem fly. MACS 1410 showed resistance against pest complex, stem fly and girdle beetle. Likewise, MACS 1336 was identified as a donor for resistance to charcoal rot disease.

Soybean breeder seed production

A total of 226.80 quintals of breeder seed of soybean was supplied to the public and private seed multiplying agencies and farmers. Likewise, 300 quintals of breeder seed of soybean has been produced during *Kharif* 2016 season.

Soybean front line demonstrations (FLDs)

Eleven FLDs were conducted on farmers' fields in Baramati taluka of Pune district and Phaltan taluka of Satara district to demonstrate and evaluate the impact of improved technology (IT) over farmer's practice (FP) using three soybean varieties MACS 1281, MACS 1188 and RKS 18. Adoption of IT increased soybean yield by 23% over FP and gave additional net returns of Rs.13427 per hectare.

Public-private partnership (PPP)

Demonstrations of recently developed soybean varieties – MACS 1188 and MACS 1281 were conducted by ITC under PPP-mode to popularize the varieties among farmers through Choupal Pradarshan Khet (CPK). This year, farmers could harvest high yield of MACS varieties due to their improved plant type.

Grape Improvement

In germplasm evaluation, fifty-five cultivars of *Vitis* were evaluated for shelf life and bunch compactness. Varieties like Anab-e-Shahi, Beauty seedless and Country Bangalore were found to have six days shelf life at room temperature whereas varieties like Cheemasahabi, Goethe, James, Jawahar, Khalili, etc. were found to have a very short shelf life of 1-2 days. Varieties like Bhokri, Black monukka, Cabernet sauvignon, Cheemasahabi, Hussani black kabuli, Rubi red, Syrah and Ugni blanc were recorded as having very compact bunches whereas Pandhari sahebi and Oval white have loose bunches. Bunch thinning is practiced during berry development as horticultural practices in case of compact bunches.

To identify and select disease resistant plants having seedless berries cuttings of ARI 516, which is a high yielding seeded hybrid, were treated with different doses of physical and chemical mutagens in 2012 and 2013. Out of total 670 cuttings, two seedless mutants were derived from 3 Kr gamma irradiation treatment. Out of them, one mutant is confirmed seedless this year, while the other came to fruiting for the first time in this year hence needs confirmation.

In grape hybridization programme, twenty-four cross combinations were attempted using 17 females and 4 seedless male parents to incorporate desirable fruit characters and disease resistance. One hundred ninety hybrids were evaluated for their fruit quality; three promising hybrids which came to fruiting for the first time out of 2012-13 crossing programme, were recorded to have rudimentary seeds. These were from 'Bangalore blue x Tas-A-Ganesh', 'Goethe x Manik chaman' and 'Isabella x Tas-A-Ganesh' crosses. Other quality parameters will be evaluated next year.

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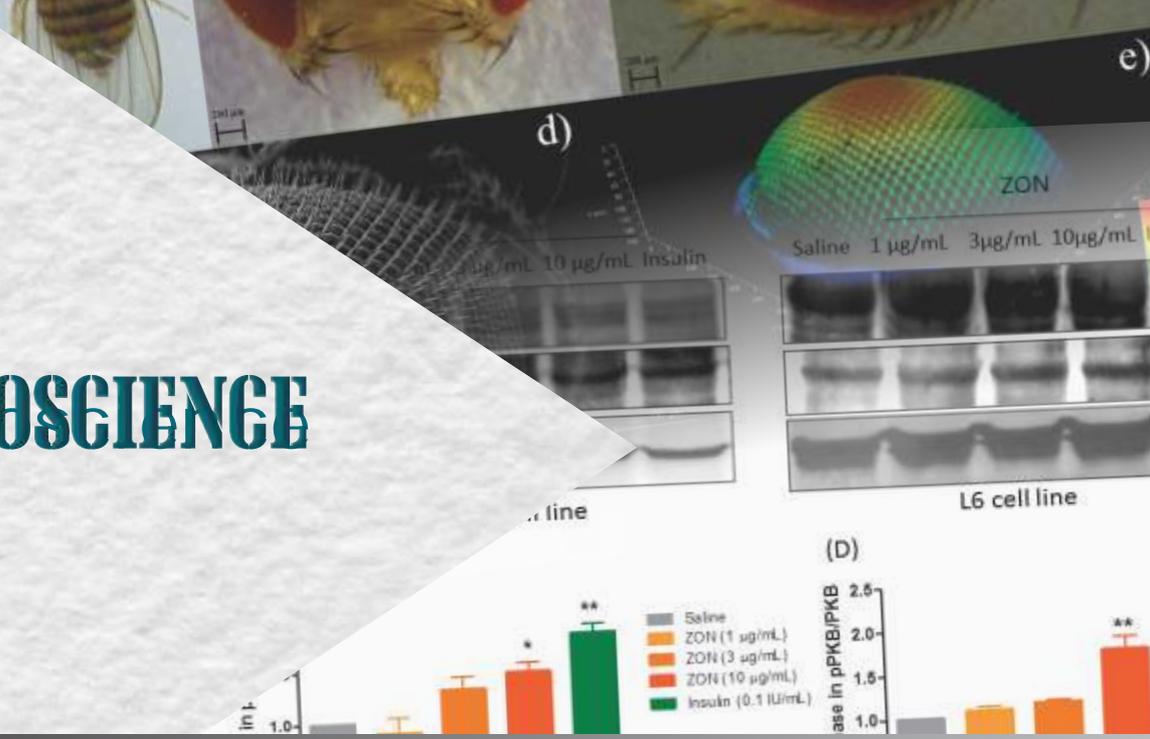


Dr Virendra A Gajbhiye



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NANOBIO SCIENCE



Nanomedicine, applications of nanomaterials in diagnostics, creating bioinspired structures, and understanding processes underlying viral replication are focused upon under Nanobioscience.

Mechanisms underlying the antidiabetic activity of zinc oxide nanoparticles

We have earlier reported that oral administration of zinc oxide nanoparticles (ZON) to type 1 and type 2 diabetic rats shows different anti-diabetic effects (viz. reduction of blood glucose, triglycerides and FFA levels; improved glucose tolerance; alleviation of oxidative stress) including increased pancreatic beta cell proliferation and insulin secretion. Considering the pleiotropic effects of ZON, a comprehensive investigation on its mechanism of action is being carried out. Here we report the effects of ZON on the phosphorylation of the primary metabolic proteins.

Increased protein tyrosine phosphatase 1B (PTP1B) activity is one of the primary abnormality in diabetes. PTP1B is a protein phosphatase which plays an important physiological role in negatively modulating insulin signaling by dephosphorylating insulin receptors and insulin receptor substrates (IRS-1). Treatment with ZON increased phosphorylated PTP1B levels suggesting its inhibition and improved insulin signaling (Figure 33).

Figure 33

Western blot images of PTP1B in (A) HepG2 and (B) L6 cells. Fold change in phosphorylated form of PTP1B (C and D)

Protein kinase B (PKB) is another important intermediate in insulin signaling. Several reports suggest that PKB mediates many downstream events including GLUT4 translocation, glucose uptake, glycogen synthesis, protein synthesis, pre-adipose cell differentiation and regulation of gene expression. Treatment with ZON leads to increased levels of phosphorylated PKB resulting in its activation, suggesting improved glucose metabolism in the liver as well as muscle (Figure 34).

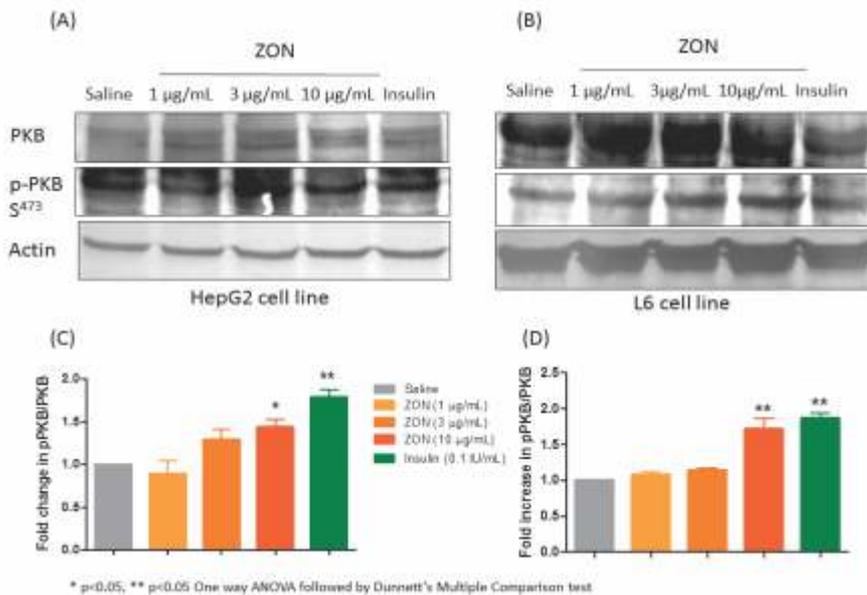


Figure 34

Western blot images of PKB in (A) HepG2 and (B) L6 cells. Fold change in phosphorylated form of PKB (C and D)

Magnetic nanoparticles mediated bimodal treatment of breast cancer

Radio-frequency induced hyperthermia combined with drugs is fast emerging as a promising option for cancer treatment. Application of low radio-frequency raises the temperature of magnetic nanoparticles to the tune of $\geq 42^\circ\text{C}$, leading to the selective killing of the cancerous cells. Furthermore, bimodal treatment with chemotherapeutic drugs loaded on magnetic nanoparticles will contribute to an increase in the concentration of pharmacologically active agent at the target site and a reduction of drug-associated toxicity in healthy tissues. In this study, chitosan coated magnetic $\text{La}_{0.7}\text{Sr}_{0.3}\text{MnO}_3$ nanoparticles (C-LSMO NPs, 90 nm) were synthesized. Under low radio-frequency, C-LSMO NPs showed excellent colloidal stability, superparamagnetic nature and heating capacity. Chitosan facilitated a high doxorubicin entrapment and resultant bimodal DC-LSMO NPs showed good drug release upon a 5 min RF exposure and significantly decreased the viability of MCF-7 and MDA-MB-231 cancer cell lines. Internalization of DC-LSMO NPs via the endosomal pathway led to an efficient localization of doxorubicin within the cell nucleus. The ensuing DNA damage, heat shock protein induction, and caspase production triggered apoptotic cell death. Moreover, DC-LSMO NPs successfully restricted the migration of metastatic MDA-MB-231 cancer cells (Figure 35). These data suggest that DC-LSMO NPs are potential bimodal therapeutic agents for cancer treatment and hold promise against disease recurrence and drug resistance.

Drosophila eye as a novel template for cell culture usable concave microchips

Cell culture provides the biological significance, which represents the majority of biology research. Microfluidic systems represent a novel cell culture platform that expands our ability to control the local cellular microenvironment precisely. Microfluidics is a technique that uses nanoliter liquid transport at microscale which can be employed in many different ways to design state-of-the-art chips for cell culture.

The microchips were fabricated using a simple microfabrication technique known as soft lithography. This technique offers advantages of a high degree of reproducibility of nanoscale structures. For cell culture, concave microchips were fabricated using eye of *Drosophila* as a template (Figures 36,37). The concave chip acts as an excellent cell culture substrate holding single cell per microwell. The chip can be used in single-cell analyses and eneration of tumor-like structures.

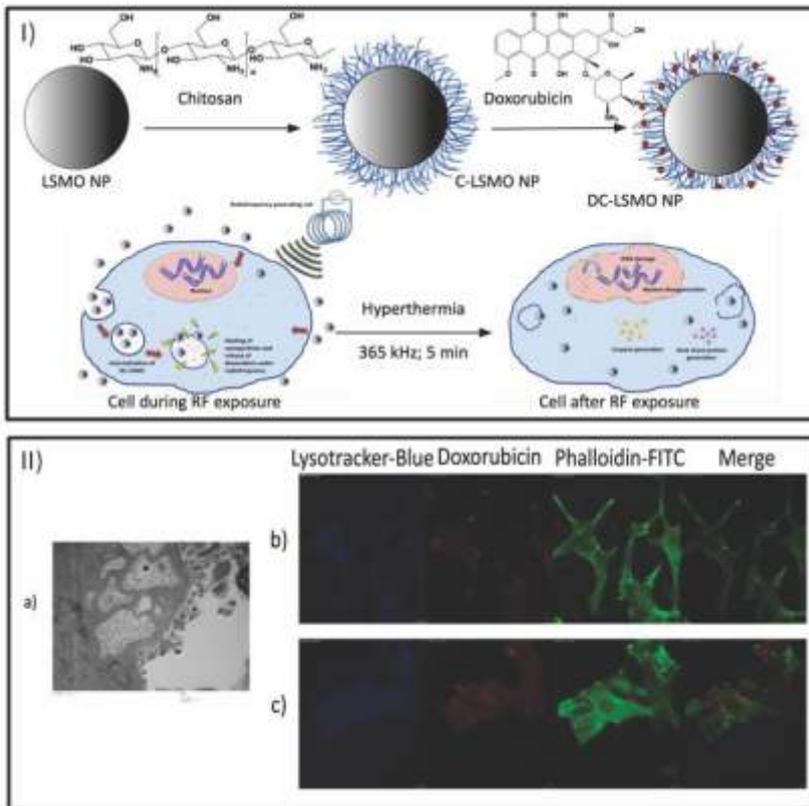


Figure 35

Schematic representing the synthesis of chitosan coated LSMO NPs and their drug loading (panel I). The lower panel depicts the fate of cancer cells when treated with the bimodal chitosan coated LSMO NPs loaded with doxorubicin (DC-LSMO NPs) for RF triggered hyperthermia and drug release. During treatment (panel II), DC-LSMO NPs are internalized by endosomes and drug released upon exposure to RF. Localization of doxorubicin in the nucleus caused DNA damage and generation of heat shock proteins and caspases (markers of apoptotic cell death)

Figure 36

(a) Dorsal view of the adult *Drosophila* female. The head bears two compound eyes (red) (b) Shows the anterior view of the *Drosophila* head with the characteristic placement of the eyes on the head capsule. (c) Close up of one-half of the *Drosophila* eye showing uniform array of ommatidia. (d) Scanning electron micrograph of the *Drosophila* eye. Note the uniformly arranged ommatidia, with a hair at the base of the ommatidium. (e) 3D reconstruction (using confocal microscope) of *Drosophila* eye showing the convex nature of the eye

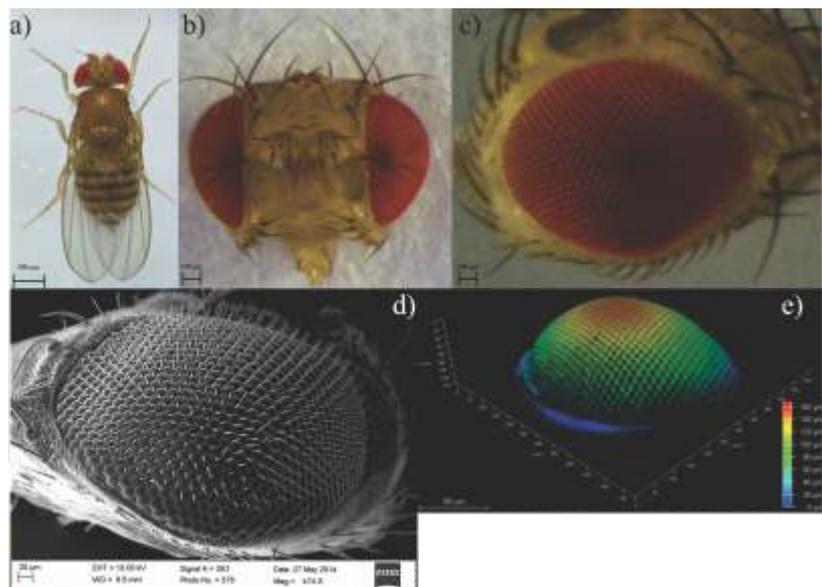
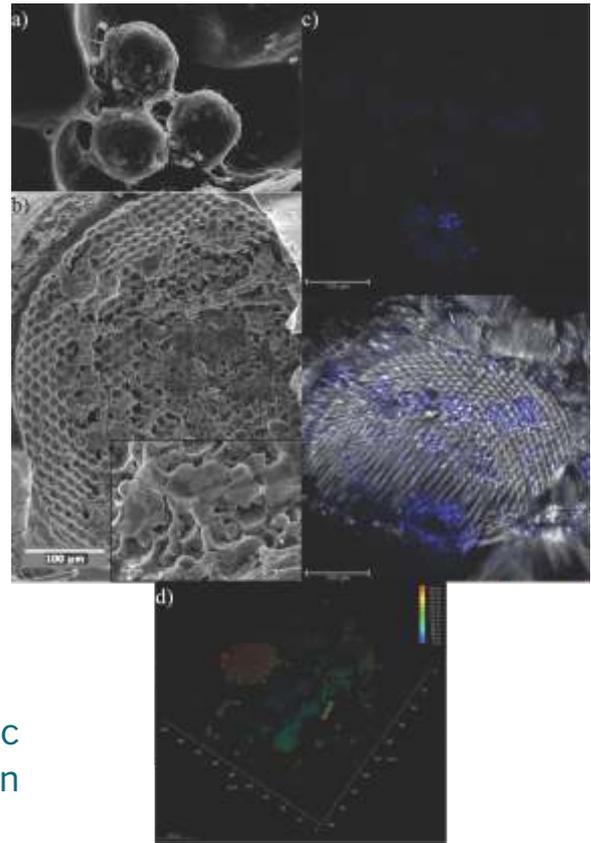


Figure 37

(a) SEM showing MCF-7 cells occupying individual wells. Note the filopodia and lamellipodia of the cells that are used for attachment. (b) Scanning electron micrograph of the chip showing MCF-7 cells grown in individual wells and adhered to the surface after 72 h, magnified image shown in inset; (c) max projection of the cast with MCF-7 cells grown for 72 h. (d) Confocal depth encoded image of MCF-7 cells after 72 h



A rapid, field-usable and robust diagnostic for detection of viral pathogens in aquaculture

Bacterial and viral infections are a constant threat to the aquaculture industry in India. Field-usable diagnostics capable of rapid detection of these pathogens are required so that massive economic losses in disease outbreaks can be prevented. Devices such as the immunochromatographic strip based assays are indeed useful, but they employ antibodies as the recognition probe for the pathogen. Antibodies can only be obtained by immunizing animals which require regulatory approvals, and the procedures are often cost- and labor-intensive. Furthermore, subtle changes in environmental conditions can lead to loss of recognition property of the antibodies. Hence, we identified a 12-amino acid long peptide that replaced the anti-WSSV antibody for the detection of the white spot syndrome virus (WSSV) in shrimp. The peptide-WSSV binding was confirmed by ELISA and western blot; with no cross-reactivity to other shrimp viruses. The peptide conjugated with gold nanoparticles was used for detection of WSSV in the lateral flow assay (LFA). The LFA test requires only 20 min, and results have been validated using gill-tissue samples collected from shrimp farms. The LFA can surely serve as the first-level screening test to eliminate WSSV-positive samples ultimately reducing the cost-burden on the farmer (Figure 38).

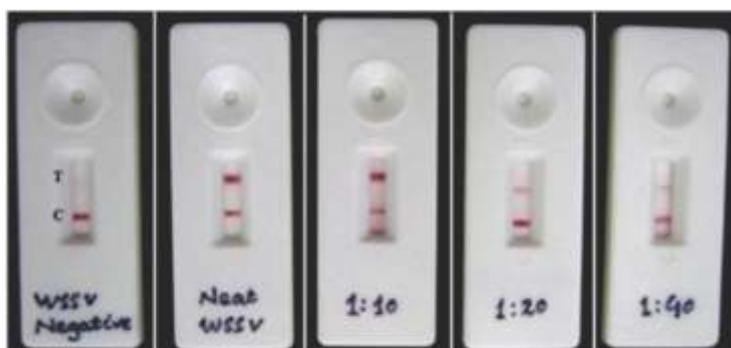


Figure 38

Lateral flow assay for detection of WSSV

Folate/N-acetyl glucosamine conjugated mesoporous silica nanoparticles for targeting breast cancer cells: A comparative study

Folate receptors (FR) have been well recognised as a marker to target nano-sized carriers for cancer diagnosis and therapy. In contrast, influx transport systems (e.g. GLUT transporters) that transport essential amino acids and nutrients to cancer cells have not been exploited much for targeted delivery. In this study, folic acid- or n-acetyl glucosamine- functionalized mesoporous silica nanoparticles loaded with doxorubicin (DOX-FA-MSNPs or DOX-NAG-MSNPs) were prepared, characterized and compared for targeting along with cytotoxicity towards breast cancer cells. Confocal microscopy and flow cytometry suggested higher cellular uptake of NAG-MSNPs than FA-MSNPs in MCF-7 and MDA-MB-231 human breast cancer cells. Cytotoxicity results showed that DOX-loaded NAG-MSNPs exerted significant higher cytotoxicity effect on both the cell lines than DOX-FA-MSNPs. Moreover, both the targeted formulations were more effective than free DOX. Our results suggested that GLUT transporters can be effectively utilized for nanoparticles internalization in breast cancer cells (Figure 39).

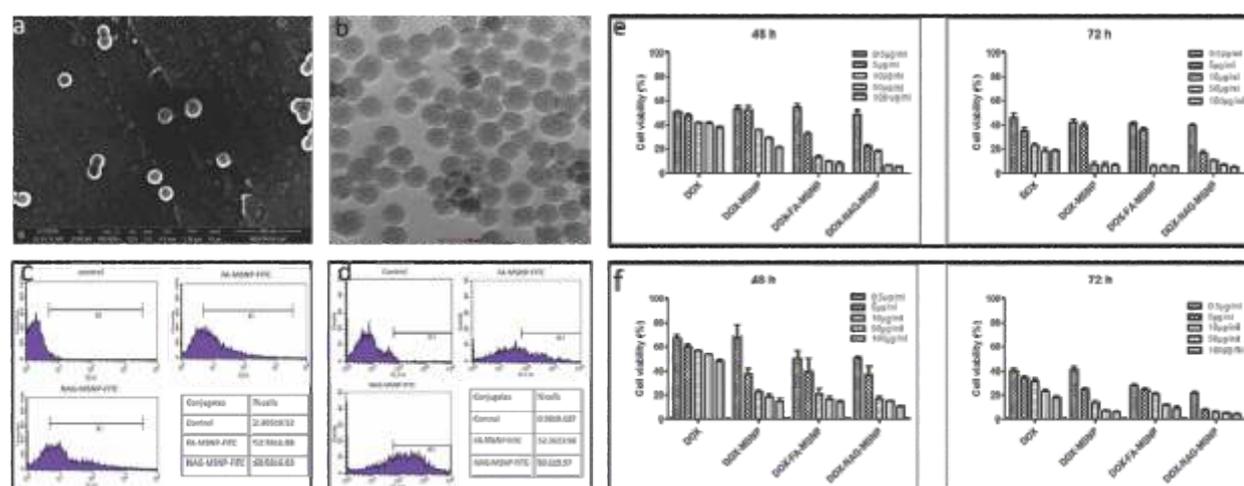


Figure 39

(a) FE-SEM image of MSNPs. (b) TEM image of MSNPs. Flow cytometry to determine internalization of FITC tagged MSNPs-conjugate in, c) MCF-7 cells and d) MDA-MB-231 cells. Cytotoxicity of DOX loaded MSNP conjugates in e) MCF-7 cells and, f) MDA-MB-231 cells

Triptorelin tethered multifunctional PAMAM-Histidine-PEG nanoconstructs enable efficient targeting and gene silencing in breast cancer cells

Breast cancer is one of the major dreadful diseases that are being studied worldwide using siRNA-based therapies. Limitations associated with siRNA treatments such as off-target effects, degradation and efficient delivery remains a major obstacle. To address these issues, we developed PAMAM-Histidine-PEG dendritic nanoconstructs functionalized with Triptorelin (a luteinizing hormone-releasing hormone analog; LHRH) for targeted delivery of siRNA to breast cancer cells. Confocal microscopy showed significantly higher cellular uptake of targeted nanoparticles (NPs) in LHRH overexpressing MCF-7 breast cancer cells than non-targeted NPs (Figure 40). The NPs demonstrated excellent serum stability and protected siRNA from degradation. The gene silencing ability of these targeted NPs was evaluated in luciferase expressing MCF-7 cell line. Gene silencing studies showed that the targeted NPs showed extremely significant ($p < 0.001$) silencing of luciferase gene as compared to non-targeted NPs. The results indicated that PAMAM-Histidine-PEG-Triptorelin could be a promising approach for specific gene silencing in LHRH overexpressing cancer cells.

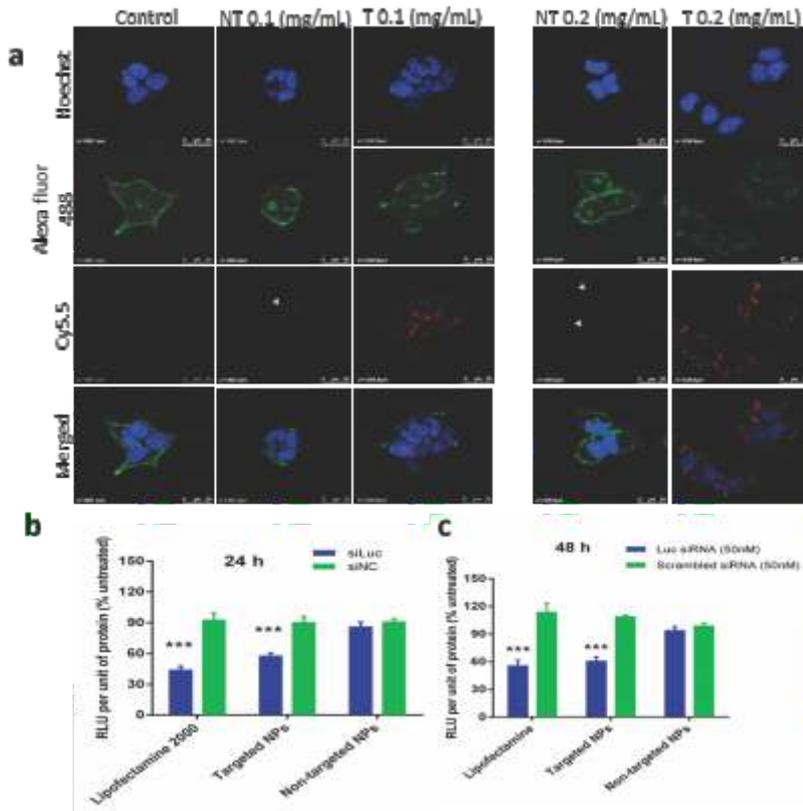


Figure 40

a. Confocal images of MCF-7 cells incubated with 0.1 and 0.2 mg/mL of targeted and non-targeted NPs for 2 h respectively. Luciferase gene silencing in Luc-MCF-7 cells. Cells were treated with siLuc and negative control siRNA complexed separately with targeted and non-targeted NPs for b.24 and c. 48 h

Proteasome activity and m-calpain are essential for Chikungunya virus replication

Chikungunya virus is a medically important mosquito-borne pathogen. It has an approximately 12 kb positive-stranded RNA genome and belongs to the genus *Alphavirus* and family *Togaviridae*. Replication of many viruses is dependent on the ubiquitin proteasome system. Our study demonstrates that Chikungunya virus replication increases proteasome activity and induces unfolded protein response (UPR) in cultured cells. Further, it was seen that the virus replication was dependent on the activities of proteasomes and m-calpain. Proteasome inhibition induced accumulation of polyubiquitinated proteins and earlier visualization of UPR.

ANNEXURE



Repositories

Agharkar Herbarium at MACS (AHMA)

Rearrangement of entire herbarium was done in light of recent changes in nomenclature concepts. Online herbarium database was maintained and updated. Additionally, 393 herbarium specimens were added to the AHMA during the reporting period. For the online database, 5050 images were scanned, 880 new entries and 2031 images were added to the online database.

Ajrekar Mycological Herbarium (AMH)

The Herbarium holds 9861 exsiccate specimens including 77 specimens received from different centers in India for deposit and accession during the period under report. In addition, 79 samples were received for identification.

Animal House

Animal Facility at ARI was established in 1999 to provide good quality laboratory animals for Institutional Research. The facility is registered with Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), Ministry of Environment and Forests, Government of India, New Delhi (Registration No. 101/GO/RBI/S/99/CPCSEA for Research and Breeding of small animals). The major responsibility of this facility is to provide quality animals to research by ensuring the persuasion of 3Rs of animal experimentation. To maintain the genetic and health status of animals, we carry out routine genetic, biochemical and hematological monitoring of laboratory animals. The Animal House team includes qualified, trained and experienced technical staff and animal caretakers. The strong veterinary support by qualified veterinarian is also available.

This year we have provided animals and supported to conduct animal experimentation involved in 10 Intra and extramural funding projects. Currently, the facility is partially upgraded by installation of IVC system to meet the requirement of maintaining transgenic animals. We also conducted lectures on the use of animals in biomedical research and demonstrated the ethical handling of laboratory animals for Ph.D. students. The animal models of various diseases were also developed that could be used to test various drugs and biologically active molecules. The facility will be soon equipped with high-end instruments such as small animal ventilator and anesthesia machines.

Crude drug repository

Crude drug repository hosts 1,387 specimens {1355 plant originated (1046 organized and 25 unorganized), 20 animal originated, 12 mineral originated} of plant part used as/in medicine collected from field and or market.

Fossil Repository

Fossil repository hosts 7970 fossil type specimens of various animal and plant groups. These include ammonoidea, bivalvia, gastropoda, bryozoa, echinoidea, foraminifera, trace fossils, intertrappean fish, plant fossils, pollens and spores collected from various localities of Peninsular India. The repository was enriched this year by the addition of 75 trace fossil specimens from western Kutch, Gujarat, India of early Cenozoic age (65 - 35 Myr).

MACS Collection of Microorganisms (MCM)

Specialized cultures of microorganisms used in various processes are being maintained in active form and supplied to researchers on demand. The specialized cultures include standard reference cultures, cultures used in metal-microbe interactions and industrial waste treatment, extremophiles such as halophilic, thermophilic and methanogenic archaea, alkaliphilic cultures.

Nation Fungal Culture Collection of India (NFCCI -WDCM 932) National Facility

As a part of the conservation of fungal diversity, live, pure and authenticated cultures of interesting fungi received from various organizations in India were deposited and accessioned. The total accession of NFCCI comes to 4088. The fungal germplasm is being maintained in culture collection by following standard long-term preservation methods, like freeze drying, distilled water, glycerol and liquid nitrogen. A total 110 authentic fungal strains were supplied to various academia, research institutions, and industry.

Library and Information Centre (LIC)

The Library and Information Centre provides access to the several international online Full Text resources as well as to the Databases like Web of Science, J-Gate. The detailed information about various services and activities of LIC is available on the institute's website www.aripune.org. The library is part of a CSIR-DST consortium known as the National Knowledge Resource Consortium (NKRC). The LIC maintains the web site of the institute.

The current holdings of the library are as follows:

Particulars	Total	Particulars	Total
Books / Bound Volumes	27387	Maps and Atlases	562
Reference Books	1125	Microfilms / Fisches	636
Ph D Thesis	338	Annual Report	499
M Sc / M Phil Thesis	97	Journals	155
ARI Reprints	3326	Digital collection/Documents	3075

Services Rendered/Offered

Crude Drug Authentication Service

ARI has been rendering the authentication service of identification/authentication of crude drug samples/specimens for academic as well as industrial purposes. Total 390 authentication reports were generated of which 40 were for industries.

Fungal Identification Service of NFCCI

529 fungal cultures, other samples received from academic, research institution and industry were authenticated / identified. As such, 169 centers including 150 academic & research institutions and 19 private centers in India benefited from various services.

Indian Patent applications

Patents	Details	Inventors
Microchip based portable real time polymerase chain reactor	E-2/500/2017-MUM, PCT/IB 2017/050456	D Bodas and KM Paknikar

Research papers/Monographs/Book Chapters/Bulletins/ Booklets

Monographs/ Book

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Paper Presented at conferences/Symposia/Seminars

Oral Presentation

11th Central European Diatom meeting, Charles University in Prague, Czech Republic, 22-25 March 2017

Karthick B. New Species of *Luticola* from Aerophilous Habitats in the Western Ghats of the Indian Subcontinent

Karthick B. Catalogue of diatom names resurrected: DIATOMBASE will be the new authority resource for diatom names and more

Bodas DS. Ultra-sensitive biosensors. Nanotechnology & Biotechnology-the pinnacle of Scientific

efforts, Nanotechnology & Biotechnology—the Pinnacle of Scientific Efforts, Gujrat, 20-24 March, 2017

Microreactor assisted synthesis of polymeric nanoparticles. Nanotechnology & Biotechnology - the pinnacle of Scientific efforts, 20-24 March, 2017

Workshop on DNA Barcoding & Phylogenetics of Plants, Agharkar Research Institute, Pune, 17-21 October 2016

Choudhary RK. Basics of Cladistics and methods of phylogenetic tree construction

Datar MN. APG system of classification and Phylogeny

Karthick B. Geography and Geology for Phylogeny

Datar MN. Grasslands of Maharashtra, Mainstreaming Biodiversity: Sustaining people and their livelihoods, Botanical Survey of India, Pune, 22 May, 2016

Understanding Vegetation of India, Bhanuben Nanawati College of Architecture, Pune, 24 June, 2016

Ghormade V. Bio-imaging and drug delivery employing chitosan nanoparticles. 11th Asia Pacific Chitin and Chitosan Symposium, Kochi, Kerala, India, 28-30 September 2016

Karthick B. Diatoms (Bacillariophyta) of the Indian subcontinent: biodiversity, biogeography and future research, National Conference on biodiversity, biology and biotechnology of algae (NCBBBA-2017), Centre for Advanced Studies in Botany, University of Madras, Chennai, 9-10 January, 2017

Kaushik T, Singh AK and Sinha DK. Late Quaternary Palaeoceanographic Changes In The Western Pacific Warm Pool: Evidence From Geochemical And Planktic Foraminiferal Records. National Conference On Quaternary Climate: Recent Findings And Future Challenges Held At National Institute Of Oceanography, Dona Paula, Goa, 28-30 April, 2016

Patwardhan V, Ratnaparkhi A, Shrivage Sand Patra C. Delivered talks on at the meeting 1st Hands-On Training Workshop on Hydra Biology, ARI, 4 -8 July, 2016

Prabir Kumar Kulabhusan. A field-usable diagnostic kit for white spot syndrome virus (WSSV) IISF – a curtain raiser, Ph.D. scholars meet, NCCS, Pune 7

Rahalkar M. Isolation of novel methanotrophs from Indian rice rhizosphere including a putative new genus within type Ia methanotrophs at the third meeting of the Bergey's International Society for Microbial Systematics (BISMIS) on *Microbial Systematics and Metagenomics*. Microbial Culture Collection, Pune, India, September 12 -15, 2016

Rajeshkumar KC. Online talk Current concepts in fungal taxonomy – A polyphasic approach in an international conference “Simposio Internacional Sobre Colecciones De Cultivos De Microorganismos, Pontificia Universidad Catolica Del Ecuador, Quito, Ecuador, 7-9 November 2016

Rajwade JM. Development of field level nanoparticles based immunodiagnosics for viral pathogens of shrimp and prawn. Brain Storming Session on WSSV/EHP, ARI, Pune, 5 August 2016

Antimicrobial nanomaterials for the control of bacterial blight disease in pomegranate. Pomegranate Research Workers Meet. College of Horticulture, Solapur, Pune, 23 August 2016

Singh SK. Represented National Fungal Culture Collection of India at 13th Asian Consortium for the Conservation and Sustainable Use of Microbial Resources, Chandigarh, 7-11 November 2016

Conservation of Fungi. National conference organized by Dyansadhana College and Mycological Society of India, 2-3 December, 2016

Umrani RD. Antidiabetic activity of Ayurvedic Medicine – Jasada Bhasma. One-day seminar on Current Scenario on Regulatory Affairs for Alternative Medicine, Patil College of Pharmacy, Akurdi, Pune, 12th November 2016

Upadhye AS. Sacred Groves: Treasure Trove of Medicinal plants, One-day seminar on Conservation of

Scared Groves, Fergusson College, Pune, 22 September, 2016

Botanical Standardization of Medicinal plants, workshop on Standardization of Medicinal Plants, 7 November, 2016

Guidelines for authentication of Medicinal plants through advance technology, One-day seminar, Pune, 10 February, 2017

Poster presentation

Akbar T, Ibarlucea B, Baraban L, Cuniberti G, Ascoli A, Tetzlaff R, Rim T, Baek C and Bodas D. Phage-based environmental nanobiosensor. 15th International Workshop on Cellular Nanoscale Networks and their Applications, Technical University of Dresden, Dresden, Germany 23-25 August 2016

Das SK, Radhakrishnan C, Kociolek P and Karthick B. Three new species of *Gomphonema* Ehrenberg, from Eastern Himalayas and note on fimbriate girdle band structure

Basargekar A. 12th National Research Scholars Meet at ACTREC, Navi Mumbai held between 15-16 December, 2016

INSPIRE Faculty Monitoring-cum-Interaction Meet", IISER Pune, 3-4 Feb 2017

Karpe Y. Chikungunya virus replication and ubiquitin system

Gajbhiye V. Engineered Nanocarriers Mediated Targeted Co-delivery of siRNA and Anti-cancer Drug for Effective Gene Silencing and Tumor Therapy

International Conference on Current Trend in Bioenergy and its applications, Modern College of Arts, Science and Commerce, Shivajinagar, India, 2017

Maheshwari S, Shetty DJ, Lanjekar VB, Dhakephalkar PK. Optimisation of process parameters for enhanced biomethanation of rice straw

Shetty DJ, Maheshwari S, Kshirsagar PR, Lanjekar VB, Singh SK, Dhakephalkar PK. Comparative evaluation of alkali and acid pretreatment for enhanced biomethanation of rice straw

Jha A. A conformationally strained β -hairpin peptide inhibitor of amyloid- β amyloidosis. The Third International symposium on Protein Folding and Dynamics, NCBS, Bangalore, November 8 - 11, 2016

An approach towards complete therapy for Alzheimer's disease. INSPIRE Faculty Monitoring-cum-Interaction Meet, KIIT University, Bhubaneswari, Odisha, 6-17 January 2017

Joshi A, Lanjekar VB, Dhakephalkar PK, Dagar SS. Evaluation of BY medium for isolation of hydrogenotrophic methanogens from diverse anaerobic environments. International Symposium & 57th Annual Conference of Association of Microbiologists of India on Microbes and Biosphere, held at Gauhati University, Assam, India, 2016

Kaushik T, Sinha DK, Singh AK, Ramesh R. Episodes of El-nino like conditions in equatorial Pacific Ocean during late Quaternary: evidence from planktic foraminiferal census and stable isotopic records. 12th International conference on Paleoceanography held at Utrecht, Netherlands, 29 August - 2 September, 2016

Mane SR, Kale D, Ghormade V, Rajamohanam PR, Badiger MV, Deshpande MV. Production of chitosan using agriculturally important fungi. 11th Asia Pacific Chitin Chitosan & 5th Indian Chitin Chitosan Society symposium, Kochi, September 29, 2016

Mane SR, Pathan EK, Ghormade V, Kulkarni SA, Deshpande MV. Expression analysis of chitin deacetylase gene in different morphological forms of *Metarhizium anisopliae* involved in host-pathogen interaction. CSIR-National Chemical Laboratory, Pune, 26 February, 2017

Rahalkar M. Culturing methane oxidizing bacteria (MOB) amongst the uncultured methanotrophs from Indian wetland rice field soil"at the third meeting of the Bergey's International Society for Microbial Systematics (BISMIS) on *Microbial Systematics and Metagenomics*, Pune, India September 12-15, 2016

Wetzel CE, Bart Van de Vijver, Ector L, Karthick B and Kociolek JP. Worrying about the little things: a review of morphological features of small freshwater Naviculoid diatoms.

Participation in Conferences /Symposia/ Seminars/ Workshop

Baghela A. Co-conducted a National Workshop on DNA Barcoding & Phylogenetics of Plants, Agharkar Research Institute, Pune, 17–21 October, 2016

Group Monitoring Workshop (GMW) organized under Young Scientist Scheme of SERB-DST Goa University, Goa, 9-10 March, 2017

India International Science Festival, CSIR–NPL, New Delhi, 7 - 11 December, 2016

Ghaskadbi S, Patwardhan V, Surekha KL and Londhe R. Organized 1st Hands-On Training Workshop on Hydra Biology, ARI, 4 -8 July, 2016

Ghaskadbi S. Conducted a conference workshop at 26th Biennial Conference, The Asian Association for Biology Education “Trends in Biology Education & Research” organized by Vidya Prabodhini College of Commerce Education, Computer & Management, Goa, 20 -24 September, 2016

Honrao BK, KJ Kumar Yashwanth, Baviskar VS and Misra SC. 55th All India Wheat and Barley Research Workers meetat CCSHAU, Hisar, 21-24 August, 2016

Honrao BK, Misra SC. Annual ACIAR Science meeting at the Australian High Commission, New Delhi, 28, June, 2016

Pre-meeting at IIWBR on ACIAR- ICAR root project IIWBR, Karnal 25 June, 2016

Honrao BK. Research Review Meeting, Crop Improvement, Lead Co-ordinators Presentation for Special Trials emidwarf dicocum Genotype, CCSHAU, Hisar, 21 August 2016

Kumar Yashwanth KJ. 8th Annual training course on standard ization of stemrust, field note sand germplasm evaluation. Kenya Agricultural and Livestock Research Organization (KALRO), Njoro, Kenya, 2-12October,2016

Kulkarni A, Lomte S and Pathak G. Workshop on the occasion of International Day for Biological Diversity 2016 with the theme: Mainstreaming biodiversity: sustaining people and their livelihoods, Botanical Survey of India, Western Regional Center, Pune, 22 May 2016

Kulkarni KG. Advanced Studies in Petrography and Micropalaeontology' for teachers conducted under the DBT Star Scheme at Fergusson College, Pune, 10 September, 2016

National Workshop, Applications of Paleontology in Archaeological Studies, Indian Museum, Kolkata, India, 9 – 11 November, 2016

Londhe RJ. Hydra Workshop at CUBE lab at Homi Bhabha Research Centre for Science and Education, 19-20 November, 2016

Misra SC. Agro vision agriculture trade fare, e-chaupal of ITC, Nagpur, 11-12 November 2016

Patil RM. International Science Festival 2016 held at NPL, New Delhi during December 7-11, 2016

Patra C, Mukherjee D, Rayrikar A. Indian Zebrafish Investigators Meeting (iZIM), Alibaug, Maharashtra, 2-5 Nov 2016

Patra C. The Weinstein Cardiovascular Development and Regeneration Meeting-2016, Duke University, Durham, USA. 19-21 May, 2016

Patwardhan V. Training on RTI-MIS to CPIOs/ FAAs of Autonomous Institutions, DST, New Delhi, 18 November, 2016

Meeting of Expert Committee held at SERB, New Delhi, 6 December, 2016

Public Health and Mobile Technologies: Latest Scientific Evidence, IIT, Delhi, 23-25, March, 2017

Shravage B. 6 Ramalingaswami Conclave, IISER, Pune, 4-6 January 2017

- Shweta K.** 12th National Research Scholars Meet at ACTREC, Mumbai, 15-16 December, 2016
- Singh PN.** One-day seminar on Scientific Hindi organized by CSIR-NCL, 19, January, 2017
- Singh SK.** One-day seminar on Scientific Hindi organized by CSIR-NCL, 19, January, 2017
- Pre-workshop of Young Scientists Congress at Bhopal, 7 March, 2017
- Srivastava P.** One Day Hindi Meeting NCL, Pune, 19th January 2017
- Tetali S.** 56 Annual conference of Maharashtra Rajya Draksha Bagaitdar Sangh, Pune, August 26-28, 2016
- Contemporary Methods of Conservation and Management of Horticultural Genetic Resources, 7
27 June, 2016
- National Conference on Horticultural Education: Present status and future prospects at Indian Institute
for Horticultural Research, Bengaluru on September 24, 2016
- National seminar on Enhancing Productivity of Fruit Crops- Mitigating Major Challenges at Indian Institute
for Horticultural Research, Bengaluru on January 8, 2017
- Training programme on PGR management in Fruit crops for at ICAR-NBPGR, New Delhi March 22-25,
2017

Invited talk

- Ghaskadbi S.** Cell Signaling molecules in hydra: Insights into evolutionarily ancient functions of signaling
pathways, 5th International Conference on Molecular Signaling: Basics to Applications, held at AU-
KBC Research Centre, Chennai, 10-12 January, 2017
- History of developmental biology in India, 41st Mahabaleshwar Seminar on Cell Biology and physics of
morphogenesis at Alibaug, 28 February 2017
- International workshop for research on the possible impact of EMF exposure from mobile towers and
handsets, IIT Delhi, 8-9 April, 2016
- National Symposium on Recent Advances in Modern Biology & Biotechnology, Dr DY Patil Vidyapeeth,
Pune, 16-17 March, 2017
- Symposium on Gene-Environment Interaction in Disease, Development and Evolution held at Banaras
Hindu University, Banaras, 5 - 6 March, 2017
- Hydra biology at Dept. of Zoology, St. Xavier's College, Mumbai, 15 February 2017
- Regulation of Animal Form, DST INSPIRE camp at Sree Siddanganga College of Arts, Science and
Commerce for Women, Tumkur, Karnataka, 23 June 2016
- Gite VD.** Post-harvest management of wheat at Farmers Mela held at Shrigonda, Dist. Ahmednagar, 1
March 2017
- Honrao BK.** Wheat cultivation practices and breeder seed production of MAS-6222 at Farmers Mela held
at Shrigonda, Dist. Ahmednagar, 1 March 2017
- Kulkarni KG.** Workshop on Advanced Studies in Petrography and Micropalaeontology for teachers
conducted under the DBT Star Scheme at Fergusson College, Pune, 10 September, 2016
- Fossil Molluscs and Their Ecology and Ichnology in Archaeology. National Workshop on Applications of
Paleontology in Archaeological Studies, Kolkata, 9-11 November, 2016
- Kumar KJ.** Quality and end use wheat at Farmers Mela held at Shrigonda, Dist. Ahmednagar, 1 March 2017
- Londhe R.** Hydra Cultivation and Regeneration, Sinhgad College of Science, Pune, 2 February, 2017
- Patra C.** Model organisms for studies on health and disease, IISER, Pune, 28-29 June, 2016

Genome Editing at Indian Zebrafish Investigators Meeting (iZIM) at Alibaug, Maharashtra, India, 2-5 November, 2016

Talk at IGIB, Noida on 27th December, 2016

Talk at Jadhavpur University, Kolkata, 20 December, 2016

MPG Partner Group Meeting at IISER-Mohali, 3-5 March, 2017

International symposium on Genome Editing Technologies and their Applications in Biology, Medicine and Agriculture, KIIT University, Bhubaneswar, India, 16-18 February, 2017

The zebrafish ventricle: A hub of cardiac endothelial cells for *in vitro* cell behavior studies, Weinstein Cardiovascular Development and Regeneration Conference, Durham, USA, May 19-21, 2016

Ratnaparkhi A. Delivered an invited talk at IISER, Bhopal, 10 December, 2016

Shravage B. Autophagy in stress, development and disease, Biotechnology Association of Abasaheb Garware College, Pune, 6 August, 2016

The discovery of autophagy specific genes (Atgs)-Prof. Yoshinori Ohsumi's contributions Nobel Laureate, NCCS, Pune, 5 December, 2016

Singh SK. Polyphasic Approach in Identification and Systematics of Fungi. National training on microbial identification: a polyphasic approach. Organized by ICAR- National Bureau of Agriculturally Important Microorganisms (NBAIM), 1-10 February, 2017

Systematics, Conservation and Applications of Endophytic Fungi. Advance Faculty Training program on Fungal Diversity and modern trends in Taxonomy through DNA Barcoding and Chemo-Profiling. Organized by CAFT Division of Plant Pathology, IARI, New Delhi, 26 September - 16 October, 2016

Tamhankar SA. DNA based authentication of medicinal plants' as a 'Resource Person' in Quality Improvement Programme on Emerging Trends in Pharmacological Research: Convergence of Molecular Targets, Poona College of Pharmacy, Pune 22 December 2016.

Visits abroad

Karthick B. Diatom Base editor meeting, Prague, Czech Republic, 20-22 March 2017

Kaushik T. 12th International conference on Paleoceanography Utrecht, Netherlands, 29 August - 2 September, 2016

Patra C. Duke University, Durham, USA between 21-22 May 2016

Heart and Lung Research, Bad Nauheim, Germany, 17 January -14 February, 2017

PhD Degree awarded

Candidate	Title	Guide
Gurav S	Significance of bioturbation and bioerosion in the Paleogene of Kachchh, India	Kulkarni KG
Ginotra Y	Studies on Interaction of Copper with L-Histidine and Histidine-rich Amyloid-b Peptide.	Kulkarni PP
Ramteke S	Understanding Role of Cu and Zn Metal ions in the Aggregation and Toxicity of Ab Peptide	Kulkarni PP
Waghole R	Exploration of <i>Tetrastigma sulcatum</i> for antifungal properties	Naik DG

Supervision of PhD students

(Guide, Co-Guide, Student, Title)

Choudhary RK, Tamhankar SA

Darshetkar A. Molecular phylogeny of the genus *Eriocaulon* L. from Western Ghats of India.

Dhakephalkar PK and Dagar SS

Pore S. Biomethanation of rice straw at elevated temperature: Assessment of microbial community dynamics

Dhakephalkar PK

Arora P. Hyperthermophiles from oil reservoir for application in enhance oil recovery

Dabir A. Investigation of biogenic methanogenesis leading to methane hydrate deposits in Krishna Godavari basin.

Dahigaokar K. Archaeal and bacterial diversity of mud volcanoes of Andaman

Honkalas V. Taxonomy and metabolite analysis of bacterial flora contributing to methane hydrates in deep submarine sediments

Maheshwari S. Metagenome and metatranscriptome analysis to gain insights into biomethanation of rice straw

Nagkirti P. A microbial process for decontamination of saturates and aromatic hydrocarbons associated with terrestrial oil spills

Shetty D. Designing microbial/ physic-chemical pretreatment for enhancement of biogas production from rice straw

Gajbhiye V

Kumar P. Nanoparticles mediated co-delivery of drug and si-RNA for treatment of drug resistant cancer

Tambe P. Nanocarrier mediated si-RNA delivery for targeting LHRH overexpressing cancer cells

Ghaskadbi S

Galande A. Analysis of the homologues of nucleotide excision repair in hydra

Dixit N. Analysis of autophagy in hydra Ghaskadbi SM and Patwardhan VG

Ghaskadbi S, Patwardhan V

Daware M. Elucidation of role of extracellular matrix protein periostin in zebrafish heart development

Turwankar A. Role of VEGF and FGF signaling in regeneration and pattern formation in hydra

Ghormade V

Kolge H. Silencing of lipase and juvenile hormone methyl transferase gene(s) in *Helicoverpa armigera* via dsRNA-nanoparticles

Jha A

Khairnar B. Designing and synthesis of novel therapeutic β -sheet breaker peptides for Alzheimer's disease

Joshi BN

Sharma S. Maternal Calcium Metabolism and Its Relation with Metabolic Syndrome in Rat Adult Offspring

Karpe Y

Kanade G. Roles of non-coding regions in the genomes of Hepatitis E virus

Kulkarni KG

Paranjape A. Sequence stratigraphic studies of the Cretaceous succession, Cauvery basin, Ariyalur area, Tamil Nadu, India.

Soman A. Studies in Paleogene bivalvia from Kachchh with special reference to palaeozoogeographic considerations (as Co-guide)

Kulkarni PP

Ranade D. Metal Ion Induced Oligomerisation and Toxicity of Amyloid Beta Peptide

Walke G. Studies of Metal Complexes of Peptides Involved in Neurological Diseases and Their Interactions with Bioactive Molecules

Ghatpande N. Development of Nutraceuticals for the Treatment of Inflammation Associated Anemia

Varma M. Thiosemicarbazone derivatives as modulators of A β induced oxidative stress and toxicity in Alzheimer's disease

Paknikar KM

Asani S. Mechanistic studies on anti-diabetic action of zinc oxide nanoparticles *in vitro*

Kulabhusan P. Phage display peptides for detection of pathogens

Kamat V. Micromixer assisted synthesis of nanoparticles: Assessment for their cellular toxicity and uptake

Raval K. Studies in immunodiagnosis of invasive Aspergillosis

Kulkarni K. Studies on surface functionalized Lanthanum Strontium Manganese Oxide nanoparticles mediated hyperthermia for the treatment of breast cancer

Rajwade JM

Chikte R. Development of nanomaterials based formulation for control of bacterial blight disease of pomegranate

Chowdhury S. Increasing seedling vigor in oil-seeds via nano-priming

Dapkekar A. Biopolymers based colloidal formulations for enhancing zinc use efficiency in wheat

Deshpande P. Nanocarriers mediated foliar delivery of zinc in wheat: studies on mechanisms of uptake and mobilization

Kumbhar J. Developing bacterial cellulose nanocomposites as scaffolds for osteochondral tissue engineering

Singh N. Studies on transcriptome profiling of biofilm bacteria treated with silver and copper nanoparticles

Ranade DR

Kajal Singh- Studies on anaerobic bacteria producing butyric acid and n-butanol from distillery waste

Ratnaparkhi A

Basargekar A. Investigation of the role of DMon1 in *Drosophila* nervous system

Shweta K. Role of FGFR and Fog signaling pathways in embryonic glial cell development of *Drosophila melanogaster*

Ratnaparkhi A and Patra C

Rayrikar A. Exploration the role of 'connective tissue growth factor a' in zebrafish development

Singh SK and Rahalkar MC

Pandit P. Exploration of taxonomic and functional diversity of methanotrophs associated with lowland paddy fields

Srivastava P

Puranik NV. Synthesis and bio-evaluation of naturally occurring chromones and their analogues

Upadhye AS

Dias L. Studies on selected Indian medicinal plants used in oral care for prevention of teeth caries

Upadhye AS, Tamhankar SA

Joshi R. Pharmacognostic and Molecular studies on Bhrihati complex

National functions

National Technology day, 11 May 2016

Workshop on Biodiversity and Technology Transfer



« (L-R) Dr Anuradha Upadhye, Dr KM Paknikar, Dr VS Bardekar, Dr RR Mungikar

Dr Vilas S Bardekar, ▶
Retd IFS
Chairman, Maharashtra State
Biodiversity Board, Pune



« Dr Rahul R Mungikar,
Senior Research Consultant
Maharashtra State
Biodiversity Board, Pune

Tree Plantation, 1 July 2016



राजभाषा का दर्जा

भारत सरकार के राजभाषा सम्बंधी आदेशों पर हमारे संस्थान में निम्नलिखित प्रयास जारी हैं।

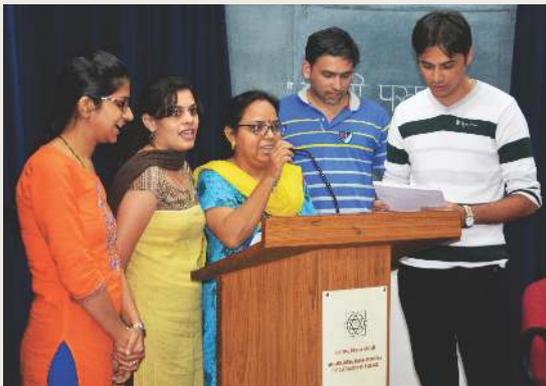
- हाल ही में हमारे संस्थान का नाम “नगर राजभाषा कार्यान्वयन समिति”, में शामिल हुआ है।
- संस्थान के मेन बिल्डींग में हररोज “आज का शब्द” (हिन्दी तथा अंग्रेजी) में लिखा जाता है। हिन्दी शब्दों से परिचित करवाने हेतु हररोज एक शब्द और उसके अंग्रेजी सम शब्द का प्रदर्शन।
- हिन्दी और अंग्रेजी में वार्षिक प्रतिवेदन कर प्रकाशन व्दिभाषी में प्रकाशित किया जाता है।
- संस्थान की वेबसाइट में हिन्दी का प्रयोग।
- सभी कम्प्यूटरों पर “सारांश” हिन्दी सॉफ्टवेअर का उपयोग।
- राजभाषा अधिनियम 1963 की धारा 3(3) के तहत परिपत्रक, सामान्य आदेश, ज्ञापन, संकल्प, अधिसूचनाएं, नियम, करार, संविदा, टेंडर नोटिस, संसदीय प्रश्न आदि हिन्दी में भेजे जाते हैं। संस्थान से भेजे जानेवाले पत्रों में हिन्दी में पत्राचार बढ़ाने पर विशेष जोर दिया जा रहा है।
- संस्थान में भिन्न सभाओं का कार्यवृत्त हिन्दी में बनाया जाता है।
- संस्थानको प्राप्त तथा संस्थान से जानेवाले सभी पत्रों की प्रविष्टियाँ हिन्दी में की जाती हैं।
- सभी वैज्ञानिक, कर्मचारी अपनी टिप्पणियाँ हिन्दी में लिखते हैं।
- हाजिरी रजिस्टर में किए जानेवाले हस्ताक्षर भी हिन्दी में किए जाते हैं।
- “राष्ट्रीय विज्ञान दिवस” के दौरान हुए प्रदर्शनी में ज्यादा से ज्यादा हिन्दी का उपयोग किया जाता है।
- हिन्दी समिती का गठन किया गया है।
- हिन्दी दिवस और पखवाड़े का आयोजन किया जाता है।
- सभी अधिकारियों के विजिटिंग कार्ड हिन्दी में छपवाएँ गए हैं।
- रबड़ की मोहरें साइनबोर्ड, सीलें, पत्र शीर्ष, नाम पट्ट हिन्दी में किए गए हैं।
- हिन्दी पुस्तकों की खरीद में वृद्धि हुई है।
- व्दिभाषी (हिन्दी+अंग्रेजी) शब्दकोष/शब्दावली तथा सहायक साहित्य खरीदे गए हैं।
- संस्थान में भर्ती तथा पदोन्नति आदि के लिए आयोजित साक्षात्कार हिन्दी में लिए जाते हैं, तथा उम्मीदवारों को हिन्दी में जबाब देने की छूट दी जाती है।
- सभी वैज्ञानिक तथा कर्मचारी, अपना अधिकांश कार्य हिन्दी में करते हैं।



Hindi Day

15 September 2016

Dr Archana Gautam ▶
Assistant Director (Rajbhasha)
Film and Television Institute of India, Pune



Hindi Pakhwada was celebrated with great fervour. Staff and students participated in giving presentations, presenting poems and singing.

Pune Traffic Awareness Programme

6 October 2016



« Vigilance Awareness Week

3 November 2016

'Public participation in promoting integrity and eradicating corruption'

Shri BA Chavan

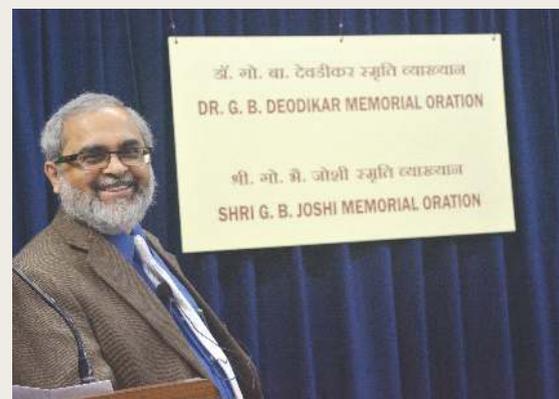
Consultant (Finance and Accounts), ARI

Dr GB Deodikar Memorial Oration ▶

17 November 2016

Improving Bioenergy Production via Genetic Engineering of Plant Cell Walls

Prof. Chandrashekhar P Joshi
Professor and Chair
Department of Biological Sciences
Michigan Technological University, USA



Shri GB Joshi Memorial Oration

17 November 2016

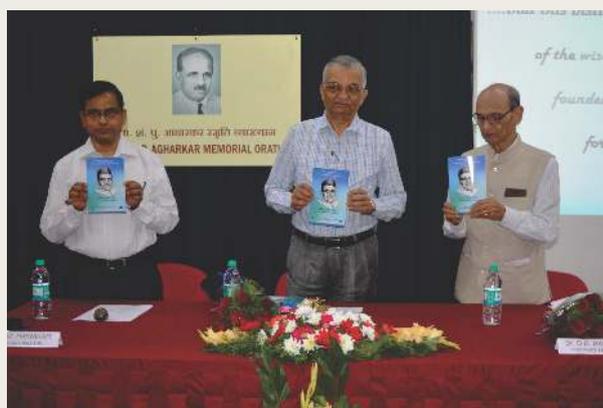
Climate Change and Crop Productivity

Prof. DP Biradar
Vice-Chancellor
University of Agricultural Sciences, Dharwad



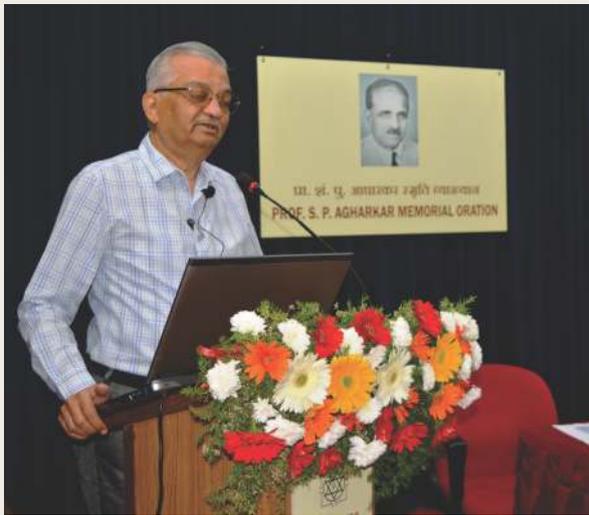
Founders Day Function

18 November 2016



Inauguration of Prof. SP Agharkar Memorabilia and release of the booklet on Prof. SP Agharkar at the hands of Dr Anil Kakodkar

56th Prof. SP Agharkar Memorial Oration



“ ‘Getting Ready for Knowledge Era’

Dr Anil Kakodkar

INAE Satish Dhawan Chair of Engineering
Eminence

Bhabha Atomic Research Centre, Mumbai

Presentation of certificates to winners of various awards



Dr Vipin Hallan - Shri VP Gokhale Prize



Dr Utpal Nath - Dr RB Ekbote Prize



Dr Vaishnavi Kulkarni - Dr PP Kanekar Award

Kisan Mela

Hol farm, 28 February 2017



The Kisan Mela was organized at MACS-Agharkar Research Institute's agricultural experimental farm at Hol on 28th February 2017. About 40 farmers from nearby village including FLD farmers attended the function. On this occasion, an exhibition was arranged for the benefit of farmers which showcased variety wise wheat seed samples of released varieties. Information regarding cultivation practices, disease management, etc was given. The farmers showed keen interest in recently released high yielding wheat varieties viz., MACS 6222, MACS 6478, MACS 3949 (d) and MACS 2971 (Khapli wheat) After the function, the farmers visited wheat breeder seed plots MACS-6478 near Hol Farm (Farmer Mr. Navnath Jagannath Magar) at village Sortewadi. The farmers expressed great satisfaction about the information received from scientist and also the yield performance of our improved wheat varieties.

National Science Day

28 February 2017

Theme: Science and Technology for Specially Abled Persons



◀ Science and Technology for Specially Abled Persons
Mr Anand Bam

Presentation by Niwant Vision

Mrs Meera Badve and team



Science Exhibition

GMRT, Khodad, Narayangaon, 28 March-1 April 2017



Workshops

National Workshop 'Role of Diatoms in Forensics', 29-31 August 2016

'Forensic tests using diatoms not used to its full potential'

ANJALI HARAR
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Pune: Noted forensic medicine expert Dr TD Dogra has said that the key tests using diatoms, usually performed during deaths caused upon drowning, are not being adequately undertaken in India owing to lack of awareness and also laboratory facilities.



The clue provided from this test can be of great significance in solving the cases and knowing the exact cause of deaths. — TD DOGRA

Diatoms are algae or living organisms composed of silica and are tracked down in these decomposed bodies, which help in determining the time, place and site in a water body.

Dogra, who has been part of the investigation teams including the killings of two prime ministers of India - Indira Gandhi and Rajiv Gandhi - was in the city on Monday to inaugurate a three-day national workshop on 'Role of Diatoms in Forensics' at Agharkar Research Institute.

Addressing the session, he said, "Though the application of diatoms is very wide, it has not been in use in forensics, especially in death cases involved in drowning. This is mainly due to lack of awareness among police and foren-

sic experts. But, the clue provided from this test can be of great significance in solving the cases and knowing the exact cause of death."

In a career spanning over four decades, Dogra had been instrumental in delivering key forensic clues also in noted cases like Arushi Talwar murder case, serial killings of Nithari, Ishrat Jahan fake encounter case in Gujarat, Shopian rape and murder case in Jammu and Kashmir, Batla house encounter, Delhi's Uphaar cinema hall fire incident, Rajasthan's Bhanwari Devi murder case, Priyadarshini Mattoo murder case, to name a few.

Explaining the applications of diatoms in forensic medicine, he said, "Its characteristic of being highly resistant makes diatoms sustain within a body for several hundreds of years. That makes it highly useful in undertaking archaeological excavations."

There have also been instances in the past when fresh investigations were ordered for criminal cases where this technique had been handy, the experts informed. Referring to the rape and murder of two young women in Shopian in Kashmir valley in 2006, which had spiralled into huge political turmoil in the valley, Dogra stated that it was the Gold Standard test, which ultimately helped solve the case, in which armed forces personnel were accused.

"The investigations had pointed fingers at rape and murder of the two women. It was only later that it was revealed that the actual cause of death was drowning triggered by flash floods in Rambisra Nallah, where the two women were found dead," he informed.

Forensic expert stresses on diatomic test to crack cases

TIMES NEWS NETWORK

Pune: Calling for increased use of diatom test in forensic investigation, experts in the field on Monday stressed it could help solve more cases of drowning.

It is a simple test, but not known to most officials conducting postmortem examinations, said forensic expert T D Dogra.

"Facilities for conducting diatom test are not available in most of the institutes of the country. Barely in 10% of the cases of drowning it is actually utilized. This is due to lack of knowledge for this type of testing and its use," said the forensic investigator of such cases as the Aarushi Murder case, Bhanwari Devi case, the Nithari killings and the Shopian rape and murder case.

Dogra was speaking at the national workshop on the Role of Diatoms in Forensics—a three-day event being held at Agharkar Research Institute in the city in association with the Government Institute of Forensic Science, Aurangabad.

CAN SOLVE DROWNING INCIDENTS

- Diatoms are a unicellular group of algae that date back to the Jurassic Period
- They are generally microscopic and are frequently used by scientists to ascertain various conditions, including water quality
- Their presence in a body can determine various factors useful for

investigation, including the place and time of death in case of drowning

■ Major cases in India, including the deaths of Daku Sunderlal, Akali Dal MP Jagdev Singh Khudiani, the Shopian double rape and murder case and Bhanwari Devi case, among others, have used diatom testing during investigation



Recalling his first ever use of diatomic test, Dogra spoke of the investigation into the death of Lt Governor Krishan Chand in 1978. "At the time I was asked in the court if a diatom sample was taken of the water in the well, from where his body was recovered, before the fact. It was then that I, along with a researcher, decided to build a diatomic database of all the water bodies in

and around Delhi," he said. "Such a database can lead to diatomic fingerprinting of all water bodies. This ensures a proper investigation and seeing the diatoms present in the sample. The database can confirm where it came from, the time of death as well as the situation of death," he said. Yet, premier institutes such as the CFSI in Delhi do not have the necessary facilities for such tests, he added.

THE CITY 3

'Lack of awareness about role of diatoms in investigations'

EXPRESS NEWS SERVICE
PUNE, AUGUST 29

There is sheer lack of awareness of a simple diatom test that can be of great help in forensic investigations, especially in cases of death due to drowning, said forensic pathologist Dr TD Dogra, while inaugurating a national workshop on the role of diatoms in forensics at MACS Agharkar Research Institute on Monday.

Diatoms are aquatic plants which play an important role in investigations, especially in cases of drowning. They help in locating the place of drowning, said Dogra, former director of AIIMS, New Delhi, citing instances where a simple diatom test had proved effective and the forensic team could establish in court that certain murder cases were actually deaths due to drowning.

Dogra gave the instance of the 'rape and murder' case of Neelofar Jan and her 17-year-old sister-in-law in Shopian. "We used the di-

If the person is alive when entering water, diatoms will enter the lungs if the person inhales water and drowns. If the person is dead when entering water, diatoms cannot enter the body.

atom test that attributed the death to accidental drowning," he said.

Diatoms found inside the body of a drowned victim may serve as corroborative evidence in diagnosing the cause of death. Dr Karthik Babubharaman, a scientist involved in research on diatoms at ARI, said Diatoms are diverse microscopic algae with silica cell walls that are found in almost every aquatic environment including fresh and marine waters.

If the person is still alive when entering the water, diatoms will

enter the lungs if the person inhales water and drowns. The diatoms are then carried to distant parts of the body such as brain, kidneys and bone marrow by circulation. If the person is dead when entering the water, then there is no circulation and the diatoms cannot enter the body.

Diatoms do not occur naturally in the body. Laboratory tests show diatoms in the corpse that are of the same species found in the water where the body was recovered, then it may be good evidence of drowning as the cause of death, the scientist explained.

Earlier Dr K M Paknikar, Director of ARI, said the institute is creating a database of diatoms in Maharashtra for preserving biodiversity. While Dogra urged more awareness about the role of diatoms, the three-day workshop will train officers, academicians, research scholars and students in the field of forensic science on their role in crime investigations and overruling shortcomings associated with diatom analysis.

Algae training for cops, labs

ARI workshop will school personnel in using diatoms for forensic investigations and raise awareness about the process

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A type of algae currently used to indicate and determine the quality of water, may soon be used more often in while investigating cases of drowning in the country. The Agharkar Research Institute (ARI) at present has 17,000 species of diatoms in its database and is working towards adding more.

A three-day national workshop on the role of diatoms in forensics will be held at the Maharashtra Association for the Cultivation of Science - Agharkar Research Institute from Monday, in collaboration with the Government Institute of Forensic Science, to raise awareness, improve the process of its collection, identification and analysis.

Personnel from the Maharashtra police, various forensic labs across the country and students pursuing forensics will be part of the workshop.

"Thousands of diatoms need to be added into the database, so that their identification for research purposes and crime investigations is easier in the future. Currently, forensic experts in our country do not have sufficient expertise—most of them still use taxonomic references that have not been updated for decades," said Karthik Babubharaman, scientist at the division of plant sciences, ARI.

"Different diatoms survive in different water bodies—this helps in determining the location of a crime and the cause of death. For instance, when diatoms are found in the bone marrow of someone suspected to have been thrown into a water body, diatoms indicate that the victim struggled," Balaraman added.

"The frequency of using the diatom test in our country is not as much as it should be, considering how simple it is," said Tithi Das Dogra, former director, All India Institute of Medical Sciences, Delhi.



Diatoms are useful in suicide cases.

He added, "Most doctors who conduct post-mortems do not know which tissue or bone marrow to take as a sample that can determine the presence of diatoms. Without this, no final results can be arrived at. Knowledge about the flora is important as the diatoms change from area to area and seasonally," said Dogra, adding, "The test was crucial in the Shopian rape and murder case in Jammu and Kashmir."

Explaining how the test works, Balaraman said, "The sample can be collected using a toothbrush and spoon, after which the diatoms are boiled in acid or a bleaching agent to disintegrate the organic content. The cell wall which is made of silica survives and provides us with clues."

Sanjay Kumar, additional DGP, criminal investigation department (CID) of Maharashtra, said, "Not too many police officers are aware of how diatoms can be used for investigation—a test provides conclusive proof in cases of suicides and drownings. The Bhanwarastote' rape case of 2011 was solved using the diatom test."

Shantikumar Gupta, director, Government Institute of Forensic Science (Aurangabad), said, "The application needs to be understood by labs and the police so that conviction rates improve."

The National Crime Records Bureau states that 1,276 individuals had drowned in Maharashtra in 2014.

The Indian EXPRESS Tue, 30 August 2016
paper edition: epaper.indianexpress.com/c/12841731

National Workshop 'DNA Barcoding & Phylogenetics of Plants',

17-21 October 2016

How safe are raw herbal drugs in India?

Prof. R. Uma Shanker

University of Agricultural Sciences, Bengaluru



National Workshop 'Standardization of Medicinal Plants', 8-9 November 2016



Inaugural lecture, 8 Nov 2016
Quality standards of Indian medicinal plants -
An ICMR initiative
Dr Neeraj Tandon
Scientist G and Head, ICMR, New Delhi



Press Clippings

Pune Mirror | SATURDAY, AUGUST 29, 2016 | 6

A Hydra demo for hands-on lessons

Professors feel dissection classes should be brought back to school, college curriculum by introducing the organism to study various zoological concepts

Prityanka Das | prityanka@pune-mirror.com

Hydra is a simple organism that is easy to maintain and study in a laboratory setting. It is a small, cylindrical, tube-like organism that lives in freshwater. It is a simple organism that is easy to maintain and study in a laboratory setting. It is a small, cylindrical, tube-like organism that lives in freshwater.

Result of dissection classes, biology and zoology students in schools and colleges often miss out on hands-on learning, a hydra-headed problem Dr Surendra Ghosalkar is hoping to fix with the demonstration of Hydra.

"Some of the genes and proteins present in the Hydra are similar to those in humans. But we have lost our regenerating abilities over the course of evolution, whereas the Hydra has tremendous regenerative capacity. Students can observe how the organism regenerates," stated Ghosalkar, an emeritus scientist from the city's Agharkar Research Institute (ARI).

Next month, teachers from across the country would be privy to how this small cylindrical freshwater organism — which has existed for more than 600 million years and is found across ponds and lakes — can be used in academic settings to study various biological and zoological concepts, with Ghosalkar's discourse at the 26th Biennial International Conference of the Asian Association for Biology Education (AABE) in Goa.

"He pointed out that the teachers need to be educated on the benefits of using Hydra as a specimen. Only then can it become popular, several countries already use the organism in laboratories as they are easy to maintain and not expensive. Acceptance of the use of the organism in laboratory academics could serve as a good source of animal observational, behavioural and experimental study at educational institutions, Ghosalkar said.

Several institutes use the Hydra in labs as its cheap, easy to maintain, and easy to study. It is a simple organism that is easy to maintain and study in a laboratory setting. It is a small, cylindrical, tube-like organism that lives in freshwater.

Hydra is a simple organism that is easy to maintain and study in a laboratory setting. It is a small, cylindrical, tube-like organism that lives in freshwater.



Hydra

THE TIMES OF INDIA, PUNE
MONDAY, JANUARY 16, 2017

Quick test for shrimps to avert huge losses

On-The-Spot Results Could Save Up To ₹1,800cr

Smita Shinde Gole | smita@timesgroup.com

THE DISEASE

Pune: A new test to detect white spot disease in shrimps that gives on-the-spot results could save Rs 1,800 crore annual loss to the aquaculture industry in the country.

The test, which could be conducted on a simple diagnostic strip by dropping a fluid from the gills of the shrimps, can detect the white spot disease in 20 minutes as against the current practice of sending samples to the laboratory and getting results in 5-6 days.

This rapid diagnostic method has been developed by city-based Agharkar Research Institute (ARI). The disease spreads among healthy shrimps in a few minutes. Scientists said the diagnostic test of the virus in the early stages will control the outbreak and the losses shrimp farming suffers.

At present, farmers spend Rs 1,000 on each sample they send for testing while the test developed by ARI would cost around Rs 100 to Rs 200 when it goes commercial. Farmers can avoid the nexus between the laboratory and the hatcheries that cheat farmers by giving false results of the tested sample.

ARI director Kishore Paknikar and author of the research article published in PLOS One journal on January 3, said, "The virus spreads so fast among the shrimps and mortality could reach up to 90% in three to 10 days of infection. The laboratory technique of detection is highly sensitive, specific and provides an accurate diagnosis. However, it is costly, time-consuming, requires specialized equipment and skilled personnel and therefore not usable in field conditions. On the other hand, dot blot strips can be used to screen individual and pooled shrimp samples."

The shrimp farming industry thrives in the coastal regions of Andhra Pradesh, Tamil Nadu, Karnataka, Kerala, West Bengal, and in Gujarat and Maharashtra on a smaller scale.

The ARI team comprised PhD student Prahar Kumar Kulakshinan and scientist Jyotika and collaborators from the OIE Reference Laboratory led by A S Sahul Hammed.

Hammed said ARI's diagnostic test will help farmers take the kit to the hatchery and test for disease themselves at a very low cost. If they find that the sample contains the virus, the farmer could avoid the batch of shrimps. If he wants to further confirm the test, he could send it to the laboratory.

"At the hatcheries, there are different tanks which are numbered and each tank contains one lakh to five lakh shrimps. The farmer usually picks samples from the tanks and send to the lab for testing. If the lab tests the sample positive for the disease then the farmer avoids taking shrimps from those tanks," he added.

- > White spot disease caused by white spot syndrome virus is one of the most devastating diseases in shrimp culture industry worldwide
- > it spread from China and Japan to Thailand, Indonesia and India, and to other shrimp-growing countries, including the US
- > The infection can be transmitted horizontally through water and infected animals, mainly through crabs and wild shrimp
- > All life stages of the penaeid shrimps, from egg to brooder, are susceptible
- > No treatment measures are available, prevention of the infection is key to containing the disease
- > Accurate diagnosis in the early stages is an efficient strategy to control an outbreak



Shrimps

Institutional Research Projects

Sr. No.	Project Code	Project Title	Investigator(s)	Associated Staff
1	BD 01	Unraveling the vascular plant endemism of Northern region of Western Ghats	MN Datar	B Shigwan
2	BD 02	Palaeozoogeographic provincialism and faunal diversity : Kachchh Paleogene basin (June 2016 - June 2017)	Kulkarni KG	Mr. Pawar S
3	GEO 17	Role of ichnofauna in deciphering sequence of deposition of the Upper Jurassic rocks of the Marwar Basin (April 2013 - March 2018)	Kulkarni KG	Mr. Salunkhe S. (Oct. 2014 onwards)
4	BD 03	Modernization of fossil repository (Core activity)	PI: Kaushik T Co-PI: Kulkarni KG	Ms. Sikilkar N. (Oct. 2016 onwards)
5	BD 04	Studying the diversity and taxonomy of modern foraminifera from coastal Maharashtra using morphological and molecular tools (July 2016 - June 2019)	PI: Kaushik T Co-PI: Dagar SS	Mr. Thirumalai M. (Oct. 2016 onwards)
6	BD 05	Screening of fungi for bio-control of powdery mildew of grapes	PN Singh SK Singh S Tettali	A Lagashetty
7	BD 06	Study of neuro-protective potential via antioxidant action and active constituents determination of parmelioid lichens from Western Himalayan Region	BC Behera A Baghela BP Sharma	S Gaikwad S Mapari R Khare
8	BIO 24	Natural supplements for the treatment of inflammation associated anemia	PP Kulkarni	N Ghatpande A Misar
9	BOT 21	Developing profiles for medicinally important species from Genus <i>Solanum</i> L. and their application in identification of market samples	AS Upadhye SA Tamhankar RK Choudhary	R Joshi
10	BOT 22	Molecular phylogeny of <i>Eriocaulon</i> L. of the Northern Western Ghats, India	RK Choudhary SA Tamhankar MN Datar	A Darshetkar
11	BOT 23	Do semi-aquatic habitats act as refugia for endemic diatoms in Western Ghats and Eastern Ghats?	K Balasubramanian	V Lokhande
12	BOT 15	Digitizing Herbarium- AHMA	MN Datar	N Gaikwad A Kulkarni
13	BOT 17	Repository of Crude drugs, Authentication service and Development of HPTLC profile library of PRS (Phytochemical Reference Standard)	AS Upadhye	A Rakshe
14	CHEM 11	Design and synthesis of analogs of naturally occurring and pharmaceutically active molecules against Chikungunya virus	P Srivastava	NV Puranik
15	DB 1	Role of VEGF and FGF Signaling in Regeneration and Pattern Formation in Hydra	V Patwardhan S Ghaskadbi	

Sr. No.	Project Code	Project Title	Investigator(s)	Associated Staff
16	DB 2	Characterization of Dmon1 expression in the embryonic CNS in <i>Drosophila</i> .	A Ratnaparkhi	
17	ZOO 15	Structural and functional characterization of pattern-forming and DNA repair genes from hydra	S Ghaskadbi V Patwardhan	
18	ZOO 16	Signaling pathways in glial cell development: the role of FGFR signaling	A Ratnaparkhi	A Basargekar
19	ZOO 17	Molecular investigations of autophagic process during starvation, tissue regeneration and protein aggregate clearance	B Shrivage PP Kulkarni S Ghaskadbi	A Bali
20	ZOO 18	Identification and functional analysis of novel regulators during heart development and regeneration	C Patra	A Rayrikar
21	GEN 15	Characterization of GA-sensitive dwarf durums at molecular level	RM Patil	V Parimal
22	GEN 16	Mapping QTL/genes for resistance to spot blotch caused by <i>Bipolaris sorokiniana</i> in durum wheat	SA Tamhankar RM Patil BK Honrao SC Misra	S Venkatesan
23	GEN 17	Mitigating the drought stress through agronomical, physiological and molecular breeding tools in soybean	SA Jaybhay RM Patil P Varghese	S Mundhe
24	MYC 02	Core activities - National Facility - Repositories and service (NFCCI, AMH, and Identification Service)	SK Singh PN Singh KC Rajeshkumar A Bhagela	D Maurya S Lad
25	MYC 07	Polyphasic taxonomy of fungal families <i>Nectriaceae</i> , <i>Mycosphaerellaceae</i> and <i>Trichocomaceae</i> with secondary metabolite profiling and database development for applied research	KC Rajeshkumar SK Singh R Umrani	S Marathe
26	MYC 08	Taxonomy, multigene phylogeny and monographic documentation of Indian <i>Fusaria</i>	SK Singh A Bhagela	S Rana
27	MYC 09	Development of multi-locus microsatellite typing (MLST) method and an efficient gene targeting system for a devastating plant fungal pathogen <i>Colletotrichum gloeosporioides</i>	A Baghela SK Singh	N Mehta
28	MIC 10	Microbial Culture Collection Activity	Dr P K Dhakephalkar Dr S S Dagar Dr M Rahalkar	
29	MIC 32	Mining the anoxic ecosystem for efficient fibrolytic microbes	Dr P K Dhakephalkar Dr S S Dagar Dr M Rahalkar	
30	BE 01	Investigating the methane mitigation potential of cultivated metanotrophs isolated from rice fields for application as bioinoculants	Dr M Rahalkar P Kshirsagar	

Sr. No.	Project Code	Project Title	Investigator(s)	Associated Staff
31	NBS 07	Modification of Lanthanum Strontium Manganese Oxide (LSMO) nanoparticles for active targeting; and assessment of tumor regression in a rodent model of breast cancer.	Dr. Rinku Umrani (PI) Dr. Virendra Gajbhiye (Co-PI) Dr. K.M. Paknikar (Co-PI)	
32	NBS 08	Development of Multitalented Nano-Platform for Targeted siRNA Delivery to LHRH Overexpressed Cancerous cells	Dr. Virendra Gajbhiye Dr. K. M. Paknikar	
33	NBS-09	Study of chitosan sponge/hydrogel incorporating polymeric nanoparticles with blood clotting factors for improved hemostasis	PI: Vandana Ghormade	
34	VIRO 01	Study of Salmonella bacteriophages from environment	Dr K Banerjee, Dr. Yogesh Karpe	

Sponsored Research Projects

Sr. No	Project Code	Project Title	Sponsored By	Investigators (PI and Co-PI/s)
1	ARI/SP/001	All India Co-ordinated Research Project on Soybean (1.4.1968 onwards)	ICAR, New Delhi	Dr SP Taware Dr P Varghese
2	ARI/SP/002	All India Co-ordinated Research Project on Fruits (1.10.70 onwards)	ICAR, New Delhi	Dr S Tetali
3	ARI/SP/003	All India Co-ordinated Wheat Improvement Project (1.4.1972 onwards)	ICAR, New Delhi	Dr BK Honrao
4	ARI/SP/033	Production of Soybean Breeder Seeds of Annual Oil Seed Crops (2.2.88 onwards)	ICAR, New Delhi	Dr SP Taware Dr P Varghese
5	ARI/SP/034	Front-line Demonstrations of Annual Oil Seed Soybean (21.2.89 onwards)	ICAR, New Delhi	Dr SP Taware Dr P Varghese
6	ARI/SP/043	Front-line Demonstrations in Wheat (1.4.1993 onwards)	ICAR, New Delhi	Dr BK Honrao
7	ARI/SP/096	Wheat Breeder Seed Scheme (1995 Onwards)	ICAR, New Delhi	Dr BK Honrao
8	ARI/SP/118(A)	CRP Agrobiodiversity Project (01.04.2014 onwards)	ICAR, Karnal	Dr BK Honrao
9	ARI/SP/179	Mobilizing QTL/Genes for quality Traits into High yielding Wheat Varieties (23.09.2009 to 22.09.2016)	DBT, New Delhi	Dr SA Tamhankar Dr MD Oak
10	ARI/SP/183	Network -Project- physiological WATER use efficiency (root Traits) (23.11.09 to 23.11.2017)	ICAR, Karnal	Dr BK Honrao
11	ARI/SP/206	Biofertilization of wheat for micronutrients through conventional and molecular approaches-Phase II (22.03.2012 to 21.03.2017)	DBT, New Delhi	Dr SA Tamhankar Dr MD Oak
12	ARI/SP/207	National Network program on lichens: Bioprospecting its secondary compounds and establishing cultures and collections (21.03.2012 to 20.03.2017)	DBT, New Delhi	Dr BC Behra
13	ARI/SP/210	Copper induced oxidative stress and neurotoxicity of AB peptides in cellular model of Alzheimer's Disease (09.5.2012 to 8.05.2015) Extended upto May-2016	DBT, New Delhi	Dr PP Kulkarni
14	ARI/SP/211	Enhancing use efficiency of micronutrients: Novel delivery systems (28.06.2012 to 19.06.2017)	ICAR, New Delhi	Dr KM Paknikar Dr Satish Mishra Dr JM Rajwade Dr MD Oak
15	ARI/SP/213	Developing rapid diagnostics for the detection of Aspergillus. (03.10.2012 to 2.10.2015) Extended upto 19.09.2016	DBT, New Delhi	Dr KM Paknikar Dr V Ghormade Dr JM Rajwade Dr DS Bodas
16	ARI/SP/218	Exploitation of inter-specific biodiversity for Wheat Improvement (01.03.2013 to 28.02.2018)	DBT, New Delhi	Dr BK Honrao

Sr. No	Project Code	Project Title	Sponsored By	Investigators (PI and Co-PI/s)
17	ARI/SP/219	Antimicrobial Nanomaterials for Control of Bacterial Blight of Pomegranate (01.04.2013 to 31.03.2016) extended upto 19.09.2016)	KanBiosysPvt. Ltd., Pune	Dr KM Paknikar Dr JM Rajwade
18	ARI/SP/222	Molecular mapping of GA-sensitive dwarfing genes and crop establishment traits in durum wheat (25/06/2013 to 24/06/2016)	SERB, New Delhi	Dr RM Patil
19	ARI/SP/224	Microbial control of methane turnover in rice fields (19.07.2013 TO 18.07.2016) extended upto 23.01.2017 extended upto 23.05.17	DBT, New Delhi	Dr M Rahalkar
20	ARI/SP/226	Late Holocene vegetation, climate dynamics and human - environment interaction along Konkan coast, India (02.07.2014 to 01.07.2017)	DST, New Delhi	Dr R Limaye
21	ARI/SP/227	Chikunguniya Virus Replication & Ubiquitin System DST-INSPIRE FACULTY AWARD (01.01.2014 to 14.06.2017) (for 5 years)	DST, New Delhi	Dr Y Karpe
22	ARI/SP/228	Cell-penetrating peptides as drug delivery agents for cancer & Alzheimer DST-INSPIRE FACULTY AWARD (16.05.2014 to 15.05.2019) (for 5 years)	DST, New Delhi	Dr A Jha
23	ARI/SP/229	Engineered Nanocancer Mediated Targeted Co-delivery of siRNA & anti-cancer Drugs for Effective gene silencing & tumor therapy DST-INSPIRE FACULTY AWARD (01.07.2014 to 30.06.2019)	DST, New Delhi	Dr V Gajbhiye
24	ARI/SP/230	Development of microfluidics immunoassay for detection of salmonella typhimurium (25.07.2014 to 24.07.2017)	DST, New Delhi	Dr D Bodas Dr KM Paknikar
25	ARI/SP/231	Development of Crude Drug Repository of Genuine samples from Maharashtra (16.08.14 to 15.08.2019)	RGSTC, Mumbai	Dr AS Upadhye Dr M Datar
26	ARI/SP/232	Safe healthy food farm to table: new diagnostic tools for detection mycotoxin procedures, mycotoxin and food borne microbial pathogen (10.10.2014 to 09.10.2017)	DBT, New Delhi	Dr V Ghormade Dr JM Rajwade Dr DS Bodas
27	ARI/SP/233	Comparative evaluation of the antibacterial effect, adhesion of gingival fibroblast and epithelial attachment to titanium, zirconia and titanium with silver nano coatings. (Oct 2014 to Sept.2015)	ITI Switzerland	Dr J Rajwade
28	ARI/SP/234	Development of field level nanoparticles based immunodiagnostics for viral pathogens of shrimp and prawn (27.01.2015 to 26.01.2018)	DBT, New Delhi	Dr KM Paknikar Dr JM Rajwade
29	ARI/SP/235	Isolation of hyperthermophiles for MEOR application for reservoirs above 90 deg c. (10.02.2015 to 09.02.2017) extended upto 09.06.2017	ONGC, Ahmedabad	Dr PK Dhakephalkar Dr M Rahalkar

Sr. No	Project Code	Project Title	Sponsored By	Investigators (PI and Co-PI/s)
30	ARI/SP/236	Development of Bioremediation process for Petroleum Hydrocarbon contaminated sites using powdered microbial formulations (10.02.2015 to 09.02.2017)	ONGC, Ahmedabad	Dr PK Dhakephalkar Dr SS Dagar
31	ARI/SP/238	Improvement of end use quality of 1BL/1RS translocation containing wheat varieties by removing of Sec-1 loci and Glu-B3 using marker assisted back cross breeding (MABB) (26.03.2015 TO 25.03.2020)	DBT, New Delhi	Dr M Oak Dr SA Tamhankar
32	ARI/SP/239	Identification and analysis of extracellular matrix components important for heart development using zebrafish as model organism (12.03.2015 to 11.03.2018 for MPG part and 02.03.2016 to 01.03.2019 for DST part)	Max Planck & DST	Dr C Patra
33	ARI/SP/240	An integrated approach of molecular breeding for downy powdery mildew resistance in Grape (25.06.2015 to 24.06.2018)	DBT, New Delhi	Dr S Tetali
34	ARI/SP/241	Development of specialized microbial culture bank for energy recovery from lignite and matured oil reservoirs (29.06.2015 to 28.06.2016)	OECT, New Delhi	Dr PK Dhakephalkar Dr M Rahalkar Dr SS Dagar
35	ARI/SP/242	Dark Energy microbial biosphere in ocean sediments-geomicrobial&astobiological implications (07.07.2015 to 06.07.2018)	SERB, New Delhi	Dr A Das
36	ARI/SP/244	Impact of EMF radiation of animal development at cellular & molecular levels (30.06.2015 to 29.06.218)	SERB, New Delhi	Dr V Patwardhan Dr A Ratnaparkhi
37	ARI/SP/245	Novel indole derivatives and their metal complexes for Alzheimer's disease (18.09.2015 to 17.09.2018)	SERB, New Delhi	Dr PP Kulkarni
38	ARI/SP/246	Isolation and characterization of SRB Lysing Bacteriophage for Inhibition of petroleum field Souring and SRB Induced Corrosion (23.09.2015 to 23.09.2017)	OECT, New Delhi	Dr PK Dhakephalkar Dr SS Dagar
39	ARI/SP/247	Identification and characterization of kinetochore proteins of a devastating plant fungal pathogen <i>Collectrichumgraminicola</i> and their application in characterizing the centromeres in a genome-wide analysis. (16.11.2015 to 15.11.2018)	SERB, New Delhi	Dr A Baghela
40	ARI/SP/248	Studies on the biodiversity and bioactivity assessment of high altitudinal lichens having economic potential in Western Himalaya (21.11.2015 to 20.11.2018)	SERB, New Delhi	Dr R Khare
41	ARI/SP/249	Exploring the diversity of lignocellulose degrading thermophilic anaerobic bacteria from Indian hot springs for bioenergy applications (26.11.2015 to 25.11.2018)	SERB, New Delhi	Dr SS Dagar
42	ARI/SP/250	Marker Assisted Elimination of off-flavour generating lipoxigenase-2 gene from kunitz trypsin inhibitor free soybean genotypes (04.12.2015 to 03.12.2020)	DBT, New Delhi	Dr P Varghese

Sr. No	Project Code	Project Title	Sponsored By	Investigators (PI and Co-PI/s)
43	ARI/SP/251	Identification of enhancers regulating expression in glial subsets in Drosophila (15.02.2016 to 14.02.2019)	DST, New Delhi	Dr A Ratnaparkhi
44	ARI/SP/252	Can diatom communities across spatial and environmental gradients of Western Ghats reflect water quality conditions of streams? (26.02.2016 to 25.02.2019)	SERB, New Delhi	Dr K Balasubramanian
45	ARI/SP/253	Polyphasic taxonomy, conservation and monographic documentation of Indian Aspergillus and Penicillium species (09.03.2016 to 08.03.2019)	SERB, New Delhi	Dr Rajesh Kumar KC
46	ARI/SP/168	Digitized Inventory of Medicinal plant resources of Maharashtra. Extended upto 30.09.2017	RGSTC, Mumbai	Dr AS Upadhye
47	ARI/SP/254	Elucidating the community structure of methanogenic archaea in methane hydrates (29.03.2016 to 28.03.2019)	SERB, New Delhi	Dr V Lanjekar
48	ARI/SP/255	Studies on nanoparticles assisted dispersion of biofilms formed in drinking water distribution system (31.03.2016 to 30.03.2019)	DST, New Delhi	Dr J Rajwade Dr KM Paknikar
49	ARI/SP/256	Investigate the role Autophagy in stem cell maintenance and aging (25.05.2016 to 24.05.2021) Ramalingaswami Fellowship (2013-2014 Batch)	DBT, New Delhi	Dr B Shrivage
50	ARI/SP/257	Active micromixer mediated controlled synthesis of polymeric nanoparticles, insitu drug loading and their effect on fungal cells (30.09.2016 to 29.09.2019)	SERB, New Delhi	Dr D Bodas Dr V Ghormade Dr KM Paknikar
51	ARI/SP/258	Bio-menthanation under simulated Mars environment implies early life on Planet Mars (01.09.2016 to 30.09.2019)	ISRo, Bangalore	Dr P Dhaphalkar Dr A Das
52	ARI/SP/259	Deciphering the role of adhesion G protein-coupled receptors during heart developing using zebrafish as a model organism (22.09.2016 to 21.09.2019)	SERB, New Delhi	Dr C Patra
53	ARI/SP/260	Determine the role of autophagy in germline stem cell aging in Drosophila (21.09.2016 to 20.09.2019)	SERB, New Delhi	Dr B Shrivage
54	ARI/SP/261	Delivery of miRNA-nanoparticle complex to promote cardiac repair and regeneration after myocardial injury (26.12.2016 to 25.12.2019)	DST, New Delhi	Dr V Gajbhiye Dr KM Paknikar
55	ARI/SP/262	Understanding the morphological evolution and ecological diversification of the forest dwelling Capers in Indian subcontinent using molecular phylogenetic tools (18.10.2016 to 17.10.2019)	SERB, New Delhi	Dr RK Choudhary Dr SA Tamhankar Dr M Datar
56	ARI/SP/263	Candidate Chikungunya virus vaccine: Nanoparticle mediated delivery of recombinant antigen presenting cells (APCs) 18.03.2017 to 19.03.2020	DST(Nanomission) New Delhi	Dr Y Karpe Dr V Gajbhiye Dr KM Paknikar

Sr. No	Project Code	Project Title	Sponsored By	Investigators (PI and Co-PI/s)
57	ARI/SP/264	Development of TILLING resource in Indian durum wheat Bijaga Yellow for forward-and reverse-genetics analysis (17.03.2017 to 16.03.2020)	SERB, New Delhi	Dr RM Patil Dr SA Tamhankar Dr MD Oak
58	ARI/SP/265	Muraina-grasses of India: addressing the polymorphism and interspecific variations through morphological, ecological and molecular phylogenetic studies (23.03.2017 to 22.03.2020)	SERB, New Delhi	Dr M Datar Dr RK Choudhary Dr SA Tamhankar
59	ARI/SP/267	Improvement of storage grains: mycotoxin mitigation by nanoparticles based rapid diagnostic for mycotoxin producers and control of mycotoxin contamination by fungal metabolites (27.03.2017 to 26.03.2020)	DST, New Delhi	Dr V Ghormade Dr KM Paknikar
60		Role of BMP signaling inhibitors noggin and gremlin in pattern formation in hydra (02.05.2016 to 01.05.2019)	CSIR, New Delhi	Dr S Ghaskadbi

Personnel (List of Staff Members as of 21.03.2017)

<p>Director (Officiating) Dr KM Paknikar, Sc. G</p>	<p>Mr PR Kshirsagar, Sc. C Dr DC Kshirsagar, Technical Officer C AS Kelkar, Technical Officer B Dr VB Lanjekar, Lab Assistant C</p>
<p>Biodiversity & Paleobiology Group</p> <p>Biodiversity - Fungi Dr SK Singh, Sc. E Dr. PN Singh, Sc. C. Dr Rajesh Kumar K.C., Sc. C Dr Abhishek Baghela, Sc. C SB Gaikwad, Technical Assistant B DK Mourya, Lab Assistant C SS Lad, Lab Assistant C</p>	<p>Bioprospecting Group Dr PP Kulkarni, Sc.D Dr P Srivastava, Sc.C Dr HM Puntambekar, Technical Officer C Dr RJ Waghole, Technical Assistant B Dr AV Misar, Technical Assistant B</p>
<p>Biodiversity - Lichens Dr BC Behera, Sc. E Dr BO Sharma, Technical Officer B</p>	<p>Developmental Biology Group Dr VG Patwardhan, Sc.E Dr A Ratnaparkhi, Sc. E Dr C Patra, Sc. C Dr BV Shrivage, Sc. C RJ Londhe, Technical Officer A B Halder, Technical Assistant A AA Nikam, Lab. Assistant A</p>
<p>Biodiversity- Palaeobiology Dr KG Kulkarni, Sc. D Mr T Kaushik, Sc. B Dr PG Gamre, Technical Officer A SS Deshmukh, Lab. Assistant E NS Mane, Attendant B</p>	<p>Genetics & Plant Breeding Group Dr SA Tamhankar, Sc. F Dr BK Honrao, Sc. E Dr MD Oak, Sc. D Dr SP Tetali, Sc. C Dr P Varghese, Sc. C Dr RM Patil, Sc. C SA Jaybhay, Sc. B AM Chavan, Sc. B Dr Y Kumar K.J., Sc. B Dr VS Baviskar, Sc. B VM Khade, Technical Officer B VD Surve, Technical Officer B SP Karkamkar, Technical Officer B JH Bagwan, Technical Officer A BD Idhol, Technical Officer A SV Phalake, Technical Assistant B VD Gite, Technical Assistant B BN Waghmare, Technical Assistant B SS Khairnar, Technical Assistant B JS Sarode, Lab Assistant C</p>
<p>Biodiversity – Plants and Diatoms Dr AS Upadhye, Sc. C Dr MN Datar, Sc. C Dr RK Chaudhary, Sc. C Dr Karthick B, Sc. C KK. Patil, Technical Officer A VN Joshi, Technical Assistant B MH Mhetre, Lab Assistant D NS Gaikwad, Lab Assistant C SA Pardhi, Lab. Assistant A MD Chavan, Attendant D SN Gajbhar, Attendant D</p>	
<p>Bioenergy Group Dr PK Dhakephalkar, Sc. F Dr MC Rahalkar, Sc. C Dr SS Dagar, Sc. C</p>	

<p>AA Deshpande, Technical Assistant B SS Raskar, Technical Assistant A DH Salunkhe, Laboratory Assistant C DN Bankar, Laboratory Assistant B PG Lavand, Laboratory Assistant A AD Sonvalkar, Driver (Special Grade) MT Gurav, Attendant C TA Kolte, Attendant C RD Shinde, Attendant C SL Bhandalkar, Attendant B SV Ghadge, Attendant A SR Kachhi, Attendant A DL Kolte, Attendant A TB Dhurve, Attendant A GS Rajguru, Attendant A</p>	<p>JV Deshpande, Pivate Secretary DS Zade, Assistant B MB Tiwari, Assistant B MV Patke, Assistant A PD Gagare, Assistant A SA Shaikh, Assistant A PA Tembe, Assistant A RM Salunke, Attendant C RM Dhandhore, Attendant B AB Kusalkar, Driver GH Agawan, Driver</p>
<p>Nanobioscience & Virology Group</p> <p>Dr KM Paknikar, Sc. G Dr JM Rajwade, Sc. E Dr DS Bodas, Sc. D Dr V Ghormade, Sc. D Dr RD Umrani, Sc. C Dr V Gajbhiye, Sc. C Dr YA Karpe, Sc. C RG Bambe, Technical Assistant B A Dwivedi, Technical Assistanat A SS Waghmare, Lab Assistant C Nayankumara D., Technician A</p>	<p>Accounts Unit</p> <p>SA Ashtaputre, FAO HN Mate, Officer B PP Pathak, Officer B AD Joshi, Officer A SV Kulkarni, Officer A MC Ranjane, Assistant B TV Kurhade, Assistant A AV Wable, Assistant A SR Jagtap, Assistant A RG Birwadkar, Assistant A KR Sathe, Attendant A</p>
<p>Animal House</p> <p>Dr SH Jadhav, Sc. C MB Daware, Technical Officer B KV Tiwari, Attendant A VM Gosavi, Attendant A</p>	<p>Purchase Unit</p> <p>PV Gosavi, Stores & Purchase Officer SA Tembe, Officer B SS Kalekar, Assistant A SS Chavan, Assistant A DV Gavade, Assistant A RB Dhobale, Assistant A AT Salvi, Attendant B</p>
<p>Director's Office</p> <p>Dr GK Wagh, Technical Officer D Dr PP Apte, Technician B RS Shinde, Assistant A SP Balsane, Attendant A</p>	<p>Store Unit</p> <p>VG Tallu, Officer A US Kulkarnii, Officer A AG Dhongade, Sr. PS</p>
<p>Administration Unit</p> <p>G Barik, Administrative Officer VB Bhalerao, Officer B CD Nagpure, Officer A</p>	<p>Engineering Unit</p> <p>AV Chaudhari, Technical Officer D M Khrade, Technical Officer C PV Sawant, Technical Officer A RG Murade, Technician A DS Shinde, Technician A SB Karanjekar, Attendant D</p>

<p>Library</p> <p>Dr SN Kulkarni, Pr. Lib. & Info. Officer RP Janrao, Asst. Lib. & Info. Officer S Deshmukh, Sr. Lib. Assistant AD Patil, Assistant B RR Kale, Attendant B</p>	<p>DH Salunkhe, Lab. Asstt. C SS Waghmare, Lab. Asstt. C VD Surve, Tech. Officer B MB Daware, Tech. Officer B MH Mhetre, Lab. Asstt. D SP Karkamkar, Tech. Officer B AV Chaudhari, Tech. Officer D NS Gaikwad, Lab. Asstt. C BD Idhol, Tech. Officer A M Kharade, Tech. Officer C Dr BO Sharma, Tech. Officer B</p>
<p>Other Technical Staff</p> <p>Shri RK Dongre, Technical Officer D Shri BA Kawthekar, Technician D</p>	<p>NTMS</p> <p>SL Bhandalkar, Attendant B TA Kolte, Attendant D</p>
<p>Promotions</p> <p>Technical Staff</p> <p>Dr VB Lanjekar, Lab. Asstt. C RJ Londhe, Tech. Officer A</p>	

Appointments

Sr. No.	Name & Designation	Group/ Unit	Date of Joining
Scientific			
1	Dr Yashwant Kumar KJ, Scientist B	Genetics & Plant Breeding	15.04.2016
2	Dr VS Baviskar, Scientist B	Genetics & Plant Breeding	15.04.2016
Ministerial			
1	Ms PA Tembe, Assistant A	Administration	12.04.2016
2	Mr RG Birwadkar, Assistant A	Genetics & Plant Breeding	02.05.2016
3	Mrs SA Ashtaputre, FAO	Accounts	01.11.2016

<p>Superannuation</p> <p>Dr SM Ghaskadbi, Scientist G, 30.04.2016 Mr AS Waghole, Technician D, 31.05.2016 Mr VK Nalawade, Lab. Asstt. D, 31.05.2016 Mr GM Ingale, Attendant B, 31.05.2016 Mr RD Shinde, Attendant C, 31.03.2017</p>	<p>Reservation & Concessions</p> <p>To provide adequate representation of SCs, STs and OBCs in direct recruitment posts instructions given by the Govt. of India, Dept. of Per. & Trg. OM NO.36012/2/96-Estt. (Res.), dated 2 July 1997 have been implemented.</p>																														
<p>Voluntary Retirement</p> <p>Dr CN Dandage, Tech. Officer C, 31.05.2016 Dr SP Taware, Scientist F, 18.01.2017</p>	<p>Details of posts filled during 2016-2017</p> <table border="1"> <thead> <tr> <th>Group</th> <th>SC</th> <th>ST</th> <th>OBC</th> <th>General</th> <th>Total</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>-</td> <td>-</td> <td>1</td> <td>2</td> <td>3</td> </tr> <tr> <td>B</td> <td>--</td> <td>--</td> <td>--</td> <td>-</td> <td>-</td> </tr> <tr> <td>C</td> <td>1</td> <td>--</td> <td>--</td> <td>1</td> <td>2</td> </tr> <tr> <td>Total</td> <td>1</td> <td>0</td> <td>1</td> <td>3</td> <td>5</td> </tr> </tbody> </table>	Group	SC	ST	OBC	General	Total	A	-	-	1	2	3	B	--	--	--	-	-	C	1	--	--	1	2	Total	1	0	1	3	5
Group	SC	ST	OBC	General	Total																										
A	-	-	1	2	3																										
B	--	--	--	-	-																										
C	1	--	--	1	2																										
Total	1	0	1	3	5																										
<p>Resigned</p> <p>Dr BN Joshi, Scientist D, 30.04.2016</p>																															

Fellows as on 31.03.2017

<p>Research Associate</p> <p>ARI Projects</p> <p>Dr Anupama Engineer</p>	<p>Research Student</p> <p>Abhijeet Rakshe Abhijit Kulkarni Arundhati Bali Ashwini Darshetkar Bhairavnath Waghmode Bhushan Shigwan Chaitali Pawase Girish Pathak Lourelle Dias Namra Sikilkar Nida Sayed Niketa Chauhan Nikhil Ashtekar Ninad Puranik Pooja Mehta Radhakrishnan Cheran Saurabh Pawar Sayali Marathe Sohan Salunkhe Sulaxna Pandey Sushen B Lomte Vini Lokhande</p>
<p>Senior Research Fellow</p> <p>Sponsored Projects</p> <p>Azhar Shaikh</p>	<p>Fellows with own fellowship</p> <p>Dr SM Ghaskadbi CSIR-Emeritus Scientist Dr V Ghate Emeritus Scientist Dr SC Misra ARI Emeritus Scientist Dr Ruta Limaye DST- Women Scientist Dr Roshani Khare SERB Young Scientist Dr Anindita Das SERB Young Scientist Soham Pore CSIR-SRF Preeti Arora CSIR-SRF Nishikant Dixit ICMR-SRF Sneha Maheshwari UGC-SRF (Tapdia) Anuprita Turvankar UGC-SRF Komal Raval UGC-SRF Mokshada Varma CSIR-JRF Rameshwar Avchar CSIR-JRF Sweta Mallik CSIR-JRF Kumal Khatri CSIR-JRF Ramesh Gaikwad CSIR-JRF Dadasaheb Sondge CSIR-JRF Gokul Patil CSIR-JRF Prajakta Tambe CSIR-JRF Kunal Pingale CSIR-JRF Pramod Kumar DBT-JRF Ameya Rayarikar DBT-JRF Sonali Mundhe DST - Inspire JRF Shraddha Rahi DST - Inspire JRF Neha Kulkarni ICMR-JRF Gajanan Chavan UGC JRF Kasturi Deore UGC-JRF Pradnya Nagkirti UGC-JRF Dnyaneshwar Pawar UGC-JRF Bhushan Khairnar UGC-JRF Rajashree Patil UGC-JRF Vaibhav Madiwal UGC-JRF</p>
<p>Junior Research Fellow</p> <p>ARI Projects</p> <p>Aboli S. Kulkarni Ajay Lagashetti Akshay Joshi Anagha Basargekar Gaytri D. Kanade Nikita Mehta Parimal Vikhe Renuka Joshi Sachin Mapari Saurabh Gaikwad Shiwali Rana Suhasini Venkatesan Sumithra Ysaswini S Thirumalai M</p> <p>Sponsored Projects</p> <p>Sneha Joshi Neelam G Kapse Sai S Hivarkar Sonal Diwanay Kiran Nilangekar Debanjan Mukharjee Nehakumari Maurya Shewta Chaudhry Diptee Trimbake LRK Jai Vidhya Anuja Patil Shaikh Irfan M Ketaki Bhate Kolge Henry Vincent Snehal Jamalpure Vijetha GV Asawari Kulkarni</p>	

AUDIT REPORT 2016-17

Maharashtra Association for the Cultivation of Science

Auditor's Report

We have audited the attached Balance sheet of Maharashtra Association for the Cultivation of Science, Pune as at 31st March, 2017 and the Income and Expenditure Account for the year ended on that date, annexed to.

These financial statements are responsibility of the Institute's Management. Our responsibility is to express opinion on these financial statements based on our Audit. We conducted our Audit in accordance with Auditing Standards generally accepted in India & Provisions of Bombay Public Trust Act, 1950 (Wherever necessary). Those standards require that we plan and perform the Audit to obtain reasonable assurance about whether the financial statements are free of material misstatements. An Audit includes examining on a test basis, evidence supporting the amounts and disclosures in the financial statements. An Audit also includes assessing the accounting principles used and significant estimates made by the management, as well as evaluating the overall financial statement presentation & reporting. We believe that our Audit provides a reasonable basis for our opinion.

Subject to above, we report that:

1. We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purpose of our Audit.
2. In our opinion, proper books of accounts as required by law have been kept by the institute so far as it appears from our examination of those books.
3. The Balance Sheet and Income and Expenditure Account dealt with by the report are in agreement with the books of accounts.
4. In our opinion and to the best of our information and according to the explanations given to us, subject to our comments in annexure to this report, the said accounts give a true and fair view.
 - i. In the case of the Balance Sheet, of the state of affairs of the Centre as at 31st March 2017
 - ii. In the case of the Income and Expenditure Account, of the Surplus for the year ended on the date.

As per our report of even date
For **M/S SPAY & CO**
Chartered Accountants
FRN:132976W

Sd/-
PARAS MUNOT
Partner
MRN:142148

Place: Pune
Date: 21/7/2017

**REPORT OF AN AUDITOR RELATING TO ACCOUNTS AUDITED
UNDER SUB-SECTION (2) OF SECTION 33 & 34 AND RULE 19 OF
THE BOMBAY PUBLIC TRUSTS ACT**

Name of the Public Trust:- MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE

For year ending: 31st March, 2017

Sr. No.	Particulars	Remarks
A	Whether accounts are maintained regularly and in accordance with the provisions of the Act and the rules	YES
B	Whether receipts and disbursements are properly and correctly shown in the accounts	YES
C	Whether the cash balance and vouchers in the custody of the manager or trustee on the date of audit were in agreement with the accounts	YES
D	Whether all books, deeds, accounts, vouchers or other documents records required by the auditor were produced before him	YES
E	Whether a register of movable and immovable properties is properly maintained, the changes therein are communicated from time to time to the regional office and the defects and inaccuracies mentioned in the previous audit report have been duly complied within	YES
F	Whether the manager or trustee or any other person required by the auditor to appear before him did so and furnished the necessary information required by him	YES
G	Whether any property or funds of the Trust were applied for any object or purpose other than the object or purpose of the Trust	NO
H	Whether tenders were invited for repairs or construction involving expenditure exceeding Rs. 5000/-	YES
I	Whether any money of the public trust has been invested contrary to the provisions of Section 35	NO
J	Alienation, if any of the immovable property contrary to the provisions of Section 36 which have come to the notice of the auditor	NO
K	All cases of irregular, illegal or improper expenditure or failure or omission to recover monies or other property belonging to the public trust or of loss or waste of money or other property thereof and whether such expenditure, failure, omission loss or waste was caused in consequence of breach of trust or misapplication or any other misconduct on the part of the trustees or any other person while in the management of the trust	NO
L	Whether the minutes books of the proceedings of the meeting is maintained	YES
M	Whether any of the trustees has any interest in the investment of the trust	NO
N	Whether the irregularities pointed out by the auditors in the accounts of the previous year have been duly complied with by the trustees during the period of audit	YES
O	Any special matter which the auditor may think fit or necessary to bring to the notice of the Deputy or Assistant Charity Commissioner	NO

As per our report of even date
For **M/S SPAY & CO**
Chartered Accountants
FRN:132976W

Sd/-
PARAS MUNOT
Partner
MRN:142148

Place: Pune
Date: 21/7/2017

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004.

Balance Sheet as on 31.3.2017

Amount - Rs.

FUNDS AND LIABILITIES	SCH.	AMOUNT	PROPERTY AND ASSET	SCH.	AMOUNT
CAPITAL ACCOUNTS	A	1,07,61,721	FIXED ASSETS	C	95,36,047
CURRENT LIABILITIES	B	17,02,921	INVESTMENTS	D	1,41,50,243
INCOME & EXP.A/C (sub Schedule 4)		1,54,70,014	DEPOSITS & ADVANCES	E	24,85,251
			CASH & BANK BALANCES	F	17,63,115
TOTAL		2,79,34,656	TOTAL		2,79,34,656

The above Balance Sheet to the best of our knowledge and belief contains a true account of the Funds, Liabilities and of the Property and Assets of the Association.

As per our report of even date
For **M/S SPAY & CO**
Chartered Accountants
FRN:132976W

Sd/-
PARAS MUNOT
Partner
MRN:142148

Sd/-
HON.F.& A.O.
M.A.C.S.

Sd/-
HON.TREASURER
M.A.C.S.

Sd/-
HON.SECRETARY
M.A.C.S.

Place: Pune
Date: 21/7/2017

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Income and Expenditure Account For The Year Ended on 31.3.2017

Amount - Rs.

EXPENDITURE	AMOUNT	INCOME	AMOUNT
Depreciation : Immovable Properties (By way of provision or adjustment)	2,965	Interest (Realised) On S.B. A/c	1,21,509
		On Investments	9,52,809
Establishment Expenses (As per Schedule H)	1,08,726	Donation in Cash	3,27,500
Audit fees	3,450	Income from other Sources (As per Schedule L)	1,75,000
Legal Fees	1,32,000	Income tax refund received	4,12,150
Professional fees	86,210	Life Membership Fees	500
Depreciation : Furniture & Dead Stock	46,149		
Expenditure on the object of The Trust (As per Schedule I)	1,25,663		
Surplus carried over to Balane sheet	14,84,305		
TOTAL	19,89,468	TOTAL	1,989,468

We hereby certify that the above income and Expenditure Account is correct to the best of our knowledge and belief.

As per our report of even date
For **M/S SPAY & CO**
Chartered Accountants
FRN:132976W

Sd/-
PARAS MUNOT
Partner
MRN:142148

Sd/-
HON.F.& A.O.
M.A.C.S.

Sd/-
HON.TREASURER
M.A.C.S.

Sd/-
HON.SECRETARY
M.A.C.S.

Place: Pune
Date: 21/7/2017

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Statement of Receipts & Payments For The Year Ended on 31.3.2017

Amount - Rs.

RECEIPTS	SCH.	AMOUNT	PAYMENTS	SCH.	AMOUNT
Opening Balances	F	9,84,877	Establishment Expenses		1,08,726
Interest Received On Savings Bank A/c		1,21,509	Expenditure on Object of Trust	K	1,25,663
Interest on Investments		4,51,433	Audit Fees & Creditors		3,450
Encashment of FDR with Bank		1,38,85,548	Legal Fees		1,32,000
Income tax refund received		4,12,150	Professional fees		86,210
			Fixed Deposit with Banks		1,41,48,418
Donation Received for Dr. R.B. Ekbote Award Dr. Kalyan Banerjee		27,500 3,00,000			
Income from Other Sources	G	1,75,000	Indirect Receipt & Payment	J	20,51,45,066
Indirect Receipt & Payment	J	20,51,54,630	Closing Balances	F	17,63,115
TOTAL		22,15,12,648	TOTAL		22,15,12,648

We hereby certify that the aforesaid statement to be true and correct to the best of our knowledge and belief.

As per our report of even date
For **M/S SPAY & CO**
Chartered Accountants
FRN:132976W

Sd/-
PARAS MUNOT
Partner
MRN:142148

Sd/-
HON.F. & A.O.
M.A.C.S.

Sd/-
HON.TREASURER
M.A.C.S.

Sd/-
HON.SECRETARY
M.A.C.S.

Place: Pune
Date: 21/7/2017

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE-411 004

Schedules to and forming part of Balance sheet as on 31.03.2017

Schedule "A" : Capital Account

Amount - Rs.

PARTICULARS	SUB-SCH	AMOUNT
TRUST FUND OR CORPUS	1	1,03,77,874
OTHER EARMARKED FUNDS	2	3,83,847
TOTAL(RS.)		1,07,61,721

Schedule "B" : Current Liabilities

Amount - Rs.

PARTICULARS	SUB-SCH	AMOUNT
OTHER LIABILITIES	3	17,02,921
TOTAL(RS.)		17,02,921

Schedule "C" : Fixed Assets

Amount - Rs.

PARTICULARS	SUB-SCH	AMOUNT.
IMMOVABLE PROPERTIES	5	91,38,337
FURNITURE AND DEAD STOCK	6	3,97,710
TOTAL(RS.)		95,36,047

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules to and forming part of Balance Sheet as on 31.3.2017

Schedule "D" : Investments

		Amount - Rs.			
Sr. No.	Name of the Company	Particulars	Date of Investment	Date of maturity	Total Rs.
SHARES					
1	Central Potteries Ltd. Nagpur	Share of Rs. 25 each Certificate No.1343 bearing Sr.No. 29114 to 29126 13 ordinary Certificate No. 551 bearing Sr.No. 3717 to 3756 40 ordinary	21.01.1949 10.06.1940	Not quoted	1,325
2	HINDUSTAN MOTORS LTD.	Shares of Rs. 10 each Share certificate No.33932 bearing Sr. No.4632651-4632700	-	-	500
FIXED DEPOSITS					
1	BANK OF MAHARASHTRA	474069 474070 60126451909 60152059714 60150708401 60161620207 60137302953 60137302238	30.12.2014 30.12.2014 01.03.2017 08.11.2015 24.10.2015 08.02.2016 09.07.2015 09.07.2015	30.12.2017 30.12.2017 01.03.2018 08.11.2017 23.10.2017 06.02.2018 05.07.2017 05.07.2017	3,00,000 3,00,000 2,00,000 16,60,000 8,00,000 4,00,000 15,36,499 33,09,383
2	INDIAN BANK	6019228988 6019228671 6056528884 6201547509 6201547485 6201547532	07.03.2015 07.03.2015 06.08.2015 24.02.2017 24.02.2017 24.02.2017	05.03.2018 05.03.2018 03.08.2018 24.02.2018 24.02.2018 24.02.2018	6,62,122 6,62,122 2,00,000 10,00,000 5,00,000 10,00,000
3	BANK OF BARODA	249183	02.03.2017	02.03.2018	91,344
4	BANK OF INDIA	50345110007246	24.11.2017	24.11.2018	15,26,948
GRAND TOTAL					1,41,50,243

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules to and forming part of Balance sheet as on 31.3.2017

Schedule "E" : Deposits & Advances

Amount - Rs.

PARTICULARS	AMOUNT	AMOUNT
DEPOSITS : (As per last Balance Sheet)		
Telephone Deposit	14,207	
Deposit with Court	15,000	29,207
ADVANCES :		
Income Tax Deducted at Source (As per last Balance Sheet)	4,80,726	
Advance to Staff	-	
Income Tax Deducted at Source	12,60,368	17,41,094
Interest accrued on Investments (Subject to confirmation from bank & other agencies)		
As per last Balance Sheet	3,19,408	
Less Realised during the year	1,33,846	
	1,85,562	
Accrued Interest during the year	5,29,388	7,14,950
TOTAL Rs.		24,85,251

Schedule "F" : Cash & Bank Balances

Amount - Rs.

PARTICULARS	AMOUNT	AMOUNT
Cash in Hand	36,275	13,038
BANK :-		
With Bank of Maharashtra Erandwana Branch in Savings A/c No.9709	8,48,653	16,24,444
With State Bank of India Deccan Gymkhana Branch in S.B. A/c No. 01100005452	35,740	
With Union Bank of India, F.C.Road Branch in S.B.A/c 48941261091951	64,209	1,25,633
TOTAL (RS.)	9,84,877	17,63,115

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules to and forming part of Statement of Receipts & Payments
and Income & Expenditure Account for the year ended on 31.3.2017

Schedule "G" : Income From Other Sources

Amount - Rs.

PARTICULARS	INCOME & EXP. ACCOUNT AMOUNT	RECEIPT & PAYMENT ACCOUNT AMOUNT
Sale of Publication	-	
Fee for Home Gardening Course	1,75,000	1,75,000
TOTAL (RS.)	1,75,000	1,75,000

Schedule "H" : Establishment Expenses

Amount - Rs.

PARTICULARS	INCOME & EXP. ACCOUNT AMOUNT	RECEIPT & PAYMENT ACCOUNT AMOUNT
Contribution to welfare fund	-	-
Honorarium to Staff	70,664	70,664
Meeting Expenses	14,909	14,909
Miscellaneous Expenses (includes Advt.Expenses)	1,216	1,216
Postage Expenses	2,822	2,822
Travelling & Conveyance	841	841
Printing & Stationery	9,275	9,275
Advertisement charges	6,375	6,375
Bank charges	2,624	2,624
TOTAL (RS.)	1,08,726	1,08,726

Schedule "I" : Expenditure on the Object of the Trust

Amount - Rs.

PARTICULARS	AMOUNT
Expenditure out of Earmarked Donations	
Prof. V.P Gokhale Award Expenses	17,110
Dr. R.B.Ekbote Award Expenses	10,850
Dr. P.P. Kanekar Award Expenses	6,243
Donation Expenses Prof. P.V.Sukhatme	750
Prof.S.P.Agharkar Chair Expenses	
Home Garden Course Expenses	78,410
Prof. S.P. Agharkar Memorial Day expenses	-
Science promotion Exps.	12,300
Public Lecture	-
Seminar Exps. Geology	-
Smt. Parvatibai Agharkar fellowship award	-
TOTAL (RS.)	1,25,663

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules to and forming part of Statement of Receipts & Payments
and Income & Expenditure Account for the year ended on 31.3.2017

Schedule "J" : Indirect Receipts & Payments

Amount - Rs.

PARTICULARS	RECEIPTS	PAYMENTS
ARI Account	19,33,27,920	19,33,27,920
Schemes Account	1,17,48,565	1,17,48,565
Advance to staff	60,350	57,350
TDS Professional fees & Contractor	15,752	11,231
Medicline Research Pvt. Ltd	1,544	-
Life Membership Fees	500	-
TOTAL	20,51,54,631	20,51,45,066

Schedule "K" : Expenditure on the Object of the Trust

Amount - Rs.

PARTICULARS	AMOUNT
Expenditure out of Earmarked Donations	
Prof. V.P Gokhale Award Expenses	17,110
Dr. R.B.Ekbote Award Expenses	10,850
Dr. P.P. Kanekar Award Expenses	6,243
Donation Expenses Prof. P.V.Sukhatme	750
Prof.S.P.Agharkar Chair Expenses	-
Home Garden Course Expenses	78,410
Prof. S.P. Agharkar Memorial Day expenses	-
Science promotion Exps.	12,300
Public Lecture	-
Seminar Exps. Geology	-
Smt. Parvatibai Agharkar fellowship award	-
TOTAL (RS.)	1,25,663

Schedule "L" : Income From Other Sources

Amount - Rs.

PARTICULARS	AMOUNT
Sale of Publication	-
Fee for Home Gardening Course	1,75,000
TOTAL (RS.)	1,75,000

As per our report of even date

For **M/S SPAY & CO**

Chartered Accountants

FRN:132976W

Sd/-
HON.F. & A.O.
M.A.C.S.

Sd/-
HON.TREASURER
M.A.C.S.

Sd/-
HON.SECRETARY
M.A.C.S.

Sd/-
PARAS MUNOT
Partner
MRN:142148

Place: Pune
Date: 21/7/2017

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules to and forming part of Balance sheet as on 31.3.2017

Schedule "1" : Trust Fund or Corpus

Amount - Rs.

PARTICULARS	AMOUNT
As per Last Balance Sheet	1,03,77,874
TOTAL(RS.)	1,03,77,874

Schedule "2" : Other Earmarked Funds

Amount - Rs.

PARTICULARS	AMOUNT
Reserve Fund (Created vide resolution No. 16 dated 12.4.1984) (As per Last Balance Sheet)	36,926
Museum Fund (As per Last Balance Sheet)	888
Prof. S.P. Agharkar Fund (As per Last Balance Sheet)	14,000
Prof. S.P. Agharkar Birth Centenary Fund (As per last Balance Sheet)	3,32,033
FDR. BANK OF BARODA	
TOTAL (RS.)	3,83,847

Schedule "3" : Other Liabilities

Amount - Rs.

PARTICULARS	AMOUNT
Advance payable to Mr B.K. Kale (As per Last Balance Sheet)	886
ARI Account	3,11,712
Audit fees payable	3,450
Medclin Research Pvt. Ltd	2,70,992
Scheme-Others	11,11,360
TDS Payable	4,521
TOTAL (RS.)	17,02,921

Schedule "4" : Income & Expenditure Account

Amount - Rs.

PARTICULARS	AMOUNT
Opening Balance	1,39,85,709
Surplus carried over to Balance sheet	14,84,305
	1,54,70,014
TOTAL (RS.)	1,54,70,014

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules to and forming part of Balance Sheet as on 31.3.2017

Sub Schedule "5" : Immovable Properties

Amount - Rs.

Sr No. Particulars	Rate of Depreciation	GROSS BLOCK			DEPRECIATION BLOCK				WDV as on 31.3.2017	
		Cost as on 01.04.16	Additions during the year	Total Cost as on 31.3.2017	Upto 31.3.2016	Dep. On opening Balance	Dep. On the Additions during the year	Total Dep. for the Year		Total as on 31.3.2017
1 Land at Pune		96,500	-	96,500	-	-	-	-	-	96,500
2 Land at Songaon		88,19,437	-	88,19,437	-	-	-	-	-	88,19,437
3 Biometry Building	2.50%	1,15,200	-	1,15,200	92,990	2,880	-	2,880	95,870	19,330
4 Microbiology Building (Refer Note A)	2.50%	3,389	-	3,389	2,817	85	-	85	2,902	487
5 Land Development Expenses at Hol		2,02,583	-	2,02,583	-	-	-	-	-	2,02,583
TOTAL (RS.)		92,37,109	-	92,37,109	95,807	2,965	-	2,965	98,772	91,38,337

MAHARASHTRA ASSOCIATION FOR THE CULTIVATION OF SCIENCE: PUNE - 411 004

Schedules to and forming part of Balance Sheet as on 31.3.2017

Sub Schedule "6" : Furniture and Dead Stock

Amount - Rs.

Sr No. Particulars	GROSS BLOCK				DEPRECIATION BLOCK						
	2	3	4	5	6	7	8	9	10	11	
	Cost as on 01.04.16	Additions during the year	Total Cost as on 31.3.2017	Rate of Depreciation	Upto 31.3.2016	Dep. On opening Balance	Dep. On the Additions during the year	Total Dep. for the Year	Total as on 31.3.2017	WDV as on 31.3.2017	
A) (I) GENERAL											
1. Office Equipments & Furniture & Sports Items	3,98,876	1,90,366	5,89,242	10%	3,89,689	-	19,037	19,037	4,08,726	1,80,516	
2. Apparatus & Equipments	2,47,036	68,040	3,15,076	20%	2,13,212	1	13,608	13,609	2,26,821	88,255	
3. Electric Fittings	9,870	-	9,870	10%	9,869	-	-	-	9,869	1	
4. Books	1,19,522	-	1,19,522	20%	1,16,440	1	-	1	1,16,441	3,081	
5. YType System for Grapes-Hol	1,10,497	-	1,10,497	10%	66,300	11,050	-	11,050	77,350	33,148	
6. Construction of Statute	98,090	-	98,090	2.5%	7,356	2,452	-	2,452	9,808	88,282	
SUB TOTAL (A)(I)	9,83,891	2,58,406	12,42,297		8,02,866	13,504	32,645	46,149	8,49,015	3,93,283	
A) (II) SPECIAL PUBLICATIONS											
1. Marathi Publication by Prof. M.N.Kamat (Cost of Rs. 1.54)	4,428	-	4,428	0%	2,367	-	-	-	2,367	2,061	

Amount - Rs.

Sr No. Particulars	GROSS BLOCK					DEPRECIATION BLOCK					
	2	3	4	5	6	7	8	9	10	11	
	Cost as on 01.04.16	Additions during the year	Total Cost as on 31.3.2017	Rate of Depreciation	Upto 31.3.2016	Dep. On opening Balance	Dep. On Additions during the year	Total Dep. for the Year	Total as on 31.3.2017	WDV as on 31.3.2017	
1											
2. Enumeration of Plants from Gomantak by Dr.V.D.Vartak (Cost of Rs. 3.60)	3,154	-	3,154	0%	1,100	-	-	-	1,100	2,054	
SUB-TOTAL (A)(II)	7,582	-	7,582	0%	3,467	-	-	-	3,467	4,115	
TOTAL A (I+II)	9,91,473	2,58,406	12,49,879	0%	8,06,333	13,504	32,645	46,149	8,52,482	3,97,398	
B) UNIVERSITY OF PUNE											
1. Office Equipment & Furniture	1,300	-	1,300	0%	1,242	-	-	-	1,242	58	
2. Books	25,538	-	25,538	0%	25,341	-	-	-	25,341	197	
3. Apparatus & Equipments	9,914	-	9,914	0%	9,891	-	-	-	9,891	23	
TOTAL (B)	36,752	-	36,752	0%	36,474	-	-	-	36,474	278	
C) GOVT.OF MAHARASHTRA											
1. Office Equipment & Furniture	1,008	-	1,008	10%	993	-	-	-	993	15	
2. Apparatus & Equipments	21,363	-	21,363	20%	21,345	-	-	-	21,345	18	
3. Books	1,210	-	1,210	20%	1,209	-	-	-	1,209	1	
TOTAL (C)	23,581	-	23,581		23,547	-	-	-	23,547	34	
GRAND TOTAL (A+B+C)	10,51,806	2,58,406	13,10,212		8,66,354	13,504	32,645	46,149	9,12,503	3,97,710	

Agharkar Research Institute of Maharashtra Association for the Cultivation of Science

Auditor's Report

We have audited the attached Balance Sheet of Agharkar Research Institute of Maharashtra Association for the Cultivation of Science, situated at Gopal Ganesh Agharkar Road, Pune as at 31st March, 2017 and Income and Expenditure Account for the year ended on that date annexed to.

These financial statements are the responsibility of the Institute's management. Our responsibility is to express an opinion on these financial statements based on our Audit. We conducted our Audit in accordance with Auditing Standards generally accepted in India & Provisions of Bombay Public Trust Act, 1950. Those standards require that we plan and perform the Audit to obtain reasonable assurance about whether the financial statements are free of material misstatements. An Audit includes examining on a test basis, evidence supporting the amounts and disclosures in the financial statements. An Audit also includes assessing the accounting principles used and significant estimates made by the management, as well as evaluating the overall financial statement presentation & reporting. We believe that our Audit provides a reasonable basis for our opinion.

Emphasis of Matter-

We draw your attention to following matter.

1. Institute has not collected TCS on Sale of Scrap of Rs.5,10,993/- As per provisions of Sec 206C of Income Tax Act 1961. Impact of the interest and penalty on Financial Statement cannot be quantified.

Assessee deemed to be Default: Sec 206 C (6/6A) of Income Tax Act 1961

- Any person responsible for collecting the tax who fails to collect the tax in accordance with the provisions of this section, shall, notwithstanding such failure, be liable to pay the tax to the credit of the Central Government in accordance with the provisions of sub-section (3).
 - If any person responsible for collecting tax in accordance with the provisions of this section does not collect the whole or any part of the tax or after collecting, fails to pay the tax as required by or under this Act, he shall, without prejudice to any other consequences which he may incur, be deemed to be an assessee in default in respect of the tax.
2. Institute has carried old outstanding balances carrying since last few years confirmation of which are not available and impact of the same on Financial Statement cannot be quantified. Party ledger balances are subject to confirmation & subsequent adjustments if any.

3. Fixed Assets and Closing Stock as on 31st March, 2017 has been Included in the financial statements as taken, valued and certified by the management of the Institute. Valuation has not been verified by us and reliance has been placed on the value of Fixed Assets and Closing Stock certified by the management.

Subject to above, we report that:

1. We have obtained all the information and explanations, which to the best of our knowledge and belief were necessary for the purpose of our Audit.
2. In our opinion, proper books of accounts as required by law have been kept by the institute so far as it appears from our examination of those books.
3. The Balance Sheet, Income and Expenditure Account and the Receipts and Payments Account dealt with by the report are in agreement with the books of accounts.
4. In our opinion and to the best of our information and according to the explanations given to us, subject to our comments in annexure to this report, the said accounts give a true and fair view.
 - i. In the case of the Balance Sheet, of the state of affairs of the Centre as at 31st March 2017
 - ii. In the case of the Income and Expenditure Account, of the surplus for the year ended on the date.
5. In our opinion, the Balance sheet & Income & Expenditure Account dealt with by this report, are in compliance with the accounting standards prescribed by the Institute of Chartered Accountants of India except the Accounting Standards – 1 “Disclosure of Accounting Policies”, Accounting Standards – 2 “Valuation of Inventories”, Accounting Standards – 5 – “Net Profit or Loss for the Period, Prior Period items and changes in Accounting Policies”, Accounting Standards – 11 – “The effects of changes in Foreign Exchange Rate”, Accounting Standards – 12 – Accounting for Government Grants”. Exceptions can be referred to Significant Accounting Policies & Notes to Account followed by the Institute and impact of the same on Financial Statement cannot be quantified.

As per our report of even date
For **M/S SPAY & CO**
Chartered Accountants
FRN:132976W

Sd/-
PARAS MUNOT
Partner
MRN:142148

Place: Pune
Date: 21/7/2017

M.A.C.S.'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Balance Sheet as on 31.03.2017

Amount - Rs.

Particulars	Sch	Current Year	Previous Year
CORPUS/CAPITAL FUND AND LIABILITIES:			
CORPUS/CAPITAL FUND	1	6,30,90,530	4,24,99,942
RESERVES AND SURPLUS	2	-	-
EARMARKED/ENDOWMENT FUNDS	3	7,45,34,200	6,43,19,932
SECURED LOANS AND BORROWINGS	4	-	-
UNSECURED LOANS AND BORROWINGS	5	-	-
DEFERRED CREDIT LIABILITIES	6	-	-
CURRENT LIABILITIES AND PROVISIONS	7	16,56,37,030	15,66,57,874
TOTAL		30,32,61,760	26,34,77,748
ASSETS:			
FIXED ASSETS	8	15,81,75,791	13,97,29,947
INVESTMENTS-FROM EARMARKED/ENDOWMENT FUNDS	9	7,97,26,866	8,07,10,703
INVESTMENTS-OTHERS	10	-	-
CURRENT ASSETS, LOANS, ADVANCES ETC.	11	6,53,59,103	4,30,37,098
MISCELLANEOUS EXPENDITURES (to the extent not written off or adjusted)		-	-
TOTAL		30,32,61,760	26,34,77,748
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

The above Balance Sheet to the best of our knowledge & belief contains a True Account of the Funds and Liabilities of the Property and Assets of the Agharkar Research Institute.

Note : Previous year's figures are regrouped wherever necessary

Sd/-
FINANCE & ACCOUNTS OFFICER
MACS ARI

Sd/-
OFFICIATING DIRECTOR
MACS ARI

As per our report of even date
For M/S SPAY & CO
Chartered Accountants
FRN:132976W

Sd/-
PARAS MUNOT
Partner
MRN:142148

Place: Pune
Date: 21/7/2017

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Income & Expenditure Account for the Year ended 31.03.2017

Amount - Rs.

Particulars	Sch	Current Year	Previous Year
Income			
Income from Sales/Services	12	29,24,139	12,99,206
Grants/Subsidies	13	18,54,36,105	18,76,30,000
Fees/Subscriptions	14	2,17,806	4,01,861
Income from Investments(Income on Invest. From earmarked/endowment Funds transferred to Funds)	15	-	-
Income from Royalty, Publications etc.	16	67,905	1,01,085
Interest Earned	17	36,90,373	89,19,860
Other Income	18	5,31,617	5,89,708
Increase/(decrease) in stock of Laboratory consumables	19	5,79,753	(4,955)
Donation Received in kind (Equipment)		-	-
Total (A)		19,34,47,698	19,89,36,765
Expenditure			
Establishment Expenses	20	12,34,95,354	13,76,37,213
Other Administrative Expenses etc.	21	3,77,63,257	3,86,49,213
Expenditure on Grants, Subsidies etc.	22	-	-
Interest	23	-	-
Depreciation (Net Total at the year-end-corresponding to schedule 8)	8	1,15,98,499	1,19,38,293
Total (B)		17,28,57,110	18,82,24,719
Balance being excess of Income over Expenditure (A-B)		2,05,90,588	1,07,12,046
Transfer to Capital fund (for capital expenditure Schedule D)		1,79,84,014	2,78,76,557
BALANCE BEING SURPLUS/(DEFICIT)CARRIED TO		1,79,84,014	2,78,76,557
CORPUS/CAPITAL FUND		26,06,574	(1,71,64,511)
SIGNIFICANT ACCOUNTING POLICIES	24		
CONTINGENT LIABILITIES AND NOTES ON ACCOUNTS	25		

Note: We hereby certify that the above Income & Expenditure account is correct to the best of our knowledge and belief.

Note : Previous year's figures are regrouped wherever necessary

Sd/-

FINANCE & ACCOUNTS OFFICER
MACS A.R.I.

Sd/-

OFFICIATING DIRECTOR
MACS A.R.I.

As per our report of even date
For M/S SPAY & CO
Chartered Accountants
FRN:132976W

Sd/-

PARAS MUNOT
Partner
MRN:142148

Place: Pune

Date: 21/7/2017

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules Forming Part of Balance Sheet as at 31.03.2017

Schedule 1: Corpus/Capital Fund

Amount - Rs.

Particulars	Current Year		Previous Year	
Balance as the beginning of the year	4,24,99,942		3,17,87,896	
Add : Contributions towards Corpus/Capital Fund (Schedule D)	1,79,84,014		2,78,76,557	
Add/ (Deduct) : Balance of Net Income/ (Expenditure)	26,06,574		(1,71,64,511)	
		6,30,90,530		4,24,99,942
Balance at the end of the year		6,30,90,530		4,24,99,942

Schedule 2: Reserves & Surplus

Amount - Rs.

Particulars	Current Year		Previous Year	
1. Capital Reserve :-				
As per last Account	-		-	
Addition during the year	-		-	
Less: Transfer to Establishment expenses	-	-	-	-
2. Revaluation Reserve :-				
As per last Account	-		-	
Addition during the year	-		-	
Less: Deductions during the year	-	-	-	-
3. Special Reserve : A.R.I. Reserve Fund :-				
As per last Account	-		-	
Addition during the year	-		-	
Add: Interest accrued	-		-	
Less: Deductions during the year	-	-	-	-
4. General Reserve :				
As per last Account	-		-	
Addition during the year	-		-	
Less: Deductions during the year	-	-	-	-
Total (Rs.)		-		-

M.A.C.S.'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004
Schedules Forming Part of Balance Sheet as at 31.03.2017

Schedule 3: Earmarked/Endowment Funds

Amount - Rs.

Particulars	FUND-WISE BREAK UP				TOTALS	
	Tech.Dev. Fund	Dr. A. B. Joshi	Dr. A. D. Agate	Welfare fund	Current Year	Previous Year
a) Opening balance of the funds	6,35,51,856	6,36,677	3,560	1,27,839	6,43,19,932	5,39,29,451
b) Additions to the funds:	-	-	-	-	-	-
i) Donations/grants	-	-	-	-	-	-
ii) Income from investments made on account of funds.	46,78,186	20,624	-	-	46,98,810	15,18,143
iii) Culture Identification Charges	17,19,106	-	-	-	17,19,106	17,19,106
iv) Overhead Charges from Scheme	18,85,479	-	-	-	18,85,479	26,88,750
v) Interest received on Funds from various projects	-	-	-	-	-	10,37,279
vi) Other Misc.	23,69,173	-	-	-	23,69,173	34,29,024
TOTAL (a+b)	7,42,03,800	6,57,301	3,560	1,27,839	7,49,92,500	6,43,21,753
c) Utilisation / Expenditure towards objectives of funds	-	-	-	-	-	-
i) Capital Expenditure	-	-	-	-	-	-
Fixed Assets	-	-	-	-	-	-
Others	-	-	-	-	-	-
ii) Revenue Expenditure	-	-	-	-	-	-
Salaries, Wages and allowances etc.	-	-	-	-	-	-
Rent	-	-	-	-	-	-
Other Administrative Expense	4,56,400	-	1,000	900	4,58,300	1,821
TOTAL (C)	4,56,400	-	1,000	900	4,58,300	1,821
NET BALANCE AS AT THE YEAR-END (a+b-c)	7,37,47,400	6,57,301	2,560	1,26,939	7,45,34,200	6,43,19,932

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules Forming Part of Balance Sheet as at 31.03.2017

Schedule 4: Secured Loans and Borrowings

Amount - Rs.

Particulars	Current Year		Previous Year	
1. Central Government		0.00		0.00
2. State Government (Specify)		0.00		0.00
3. Financial Institutions				
a. Term Loans	0.00		0.00	
b. Interest Accrued and due	0.00	0.00	0.00	0.00
4. Banks:				
a. Term Loans	0.00		0.00	
- Interest accrued and due	0.00		0.00	
b. Other Loans (Specify)	0.00		0.00	
- Interest accrued and due	0.00	0.00	0.00	0.00
5. Other Institutions and Agencies		0.00		0.00
6. Debentures and Bonds		0.00		0.00
7. Others (Specify)		0.00		0.00
TOTAL (Rs.)		0.00		0.00

Note: Amounts due within one year Nil

Schedule 5: Unsecured Loans and Borrowings

Amount - Rs.

Particulars	Current Year		Previous Year	
1 Central Government		0.00		0.00
2 State Government (specify)		0.00		0.00
3 Financial Institutions		0.00		0.00
4 Banks		0.00		0.00
a. Term Loans	0.00	0.00	0.00	0.00
b. Other Loans (Specify)	0.00	0.00	0.00	0.00
5 Other Intitutions and Agencies		0.00		0.00
6 Debentures and Bonds		0.00		0.00
7 Fixed Deposits		0.00		0.00
8 Others (Specify)		0.00		0.00
TOTAL (Rs.)		0.00		0.00

Schedule 6: Deferred Credit Liabilities

Amount - Rs.

Particulars	Current Year		Previous Year	
a. Acceptance secured by hypothecation of capital equipment and other assets	0.00	0.00	0.00	0.00
b. Others	0.00	0.00	0.00	0.00
TOTAL (Rs.)		0.00		0.00

Note: Amounts due within one year Nil

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004
Schedules Forming Part of Balance Sheet as at 31.03.2017

Schedule 7: Current Liabilities & Provisions

Amount - Rs.

Particulars	Current Year		Previous Year	
A. Current Liabilities :-				
1. Acceptances	-		-	
2. Sundry Creditors:				
a) For Goods		64,06,169		8,44,522
3. Advances Received	-		-	
4. Interest Accrued but not due on:	-		-	
a) Secured Loans/borrowings	-		-	
b) Unsecured Loans/borrowings	-		-	
5. Statutory Liabilities:	-		-	
a) Sales Tax	-		-	
b) TDS Payable	7,79,873		83,302	
c) Service Tax Payable	903		-	
d) PF Commissioner A/c	8,00,540		2,91,193	
e) P.F.New Pension Scheme	4,20,756		1,40,617	
f) State Profession Tax	26,400	20,28,472	1,600	5,16,712
6. Other current Liabilities	8,82,156	8,82,156	35,42,553	35,42,553
7. Unspent Balance of Grant	3,25,15,895		2,47,52,000	
8. Earnest Money Deposit	22,33,617		21,56,772	
9. Security deposit	8,66,226		7,69,706	
10. Other Tution Fees & University Share	1,52,383		76,291	
11. Recovery of Bank Loan	11,300		1,500	
12. Workshops Meetings etc.	20,55,715		26,33,717	
13. Scheme	7,15,421		8,88,511	
14. Retention Money	1,52,967	3,87,03,524	1,52,967	3,14,31,464
Total (A)		4,80,20,321		3,63,35,251

Particulars	Current Year		Previous Year	
B. PROVISIONS				
1. For Taxation				
2. Gratuity	6,23,76,031		5,69,58,950	
3. Superannuation/Pension	-		-	
4. Accumulated Leave Encashment	4,74,44,164		4,20,71,888	
5. Trade Warranties/Claims	-		-	
6. Others	-		-	
- Salary payable for March	68,94,024		73,20,760	
- Audit fees	11,500		16,854	
- Electricity & Power	5,19,770		3,93,630	
- Postage & Telephone	41,178		30,472	
- Campus maintenance	1,15,457		1,14,174	
- Security Service Charges	28,234		1,54,029	
- Water Charges	-		2,06,600	
- Hired Labour Charges	1,86,351		1,74,081	
- P.F. & N.P.S.	-		2,74,058	
- P.F. & N.P.S. Adm. Charges	-		3,820	
Total (B)		11,76,16,709		10,77,19,316
Total (A+B)		16,56,37,030		14,40,54,567

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004
Schedules Forming Part of Balance Sheet as at 31.03.2017
Schedule 8: Fixed Assets

Description	Gross Block				Depreciation				Net Block				
	Cost/valuation As at beginning of the year	Rate of Dep.	Additions during the year	Deletions during the year	Net cost as on 31.3.2017	Cost valuation at the year-end	As at the beginning of the year	Depreciation on the opening cost	Dep. on Additions during the year	Total dep. during the year	Total up to the Year-end	As at the Current year-end	As at the Previous year-end
A FIXED ASSETS:													
1 LAND													
a) Freehold	1,74,914	Nil	-	-	-	1,74,914	-	-	-	-	-	1,74,914	1,74,914
b) Leasehold	-	Nil	-	-	-	-	-	-	-	-	-	-	-
2 BUILDINGS:													
a) On Freehold	7,74,01,081	0	-	-	-	7,74,01,081	1,83,94,548	19,35,027	-	19,35,027	2,03,29,575	5,70,71,505	5,90,06,533
b) On Leasehold	-	Nil	-	-	-	-	-	-	-	-	-	-	-
c) Ownership Flats/Premises	-		-	-	-	-	-	-	-	-	-	-	-
d) Superstructures on Land and not boling to the entity	-		-	-	-	-	-	-	-	-	-	-	-
e) Temporary Structures	20,41,085	2.5%	2,71,616	-	2,71,616	23,12,701	6,78,782	51,011	3,395	54,407	7,33,189	15,79,512	13,62,303
3 PLANT MACHINERY & EQUIPMENT	27,88,24,778	10% / 20%	1,16,48,844	-	1,16,48,844	29,04,73,622	21,83,67,809	95,044	16,07,968	17,03,012	22,00,70,821	7,04,02,803	6,04,56,970
4 VEHICLES	24,48,857	20%	-	-	-	24,48,857	20,28,089	-	-	1,05,192	21,33,281	3,15,575	4,20,768
5 FURNITURE, FIXTURES	2,19,48,023	10%	10,01,527	1,475	10,00,052	2,29,48,075	1,60,96,384	8,23,976	58,031	8,82,007	1,69,78,391	59,69,685	58,51,639
6 COMPUTER/PERIPHERALS	1,78,25,178	20%	20,32,026	-	20,32,026	1,98,57,204	1,50,59,190	35,65,036	2,03,758	37,68,793	1,88,27,983	10,29,221	27,65,988
7 COMPUTER SOFTWARE	18,09,600	60%	13,22,750	-	13,22,750	31,32,350	18,09,600	-	4,64,116	4,64,116	22,73,716	8,58,634	-
8 ELECTRIC INSTALLATIONS	74,26,518	10% / 15%	-	-	-	74,26,518	63,08,433	6,42,029	-	6,62,733	69,71,166	4,55,353	11,18,085
9 LIBRARY BOOKS	84,90,214	20%	8,36,316	18,187	8,18,129	93,08,343	70,45,543	16,98,043	81,845	17,79,888	88,25,431	4,82,912	14,44,671
10 OTHER FIXED ASSETS	92,97,498	0	8,70,935	-	8,70,935	1,01,68,433	21,69,422	2,32,437	10,887	2,43,324	24,12,746	77,55,687	71,28,076
TOTAL OF CURRENT YEAR	42,76,87,746		1,79,84,014	19,662	-	44,56,52,098	28,79,57,800	90,42,604	24,29,999	1,15,98,499	29,95,56,299	14,60,95,800	13,97,29,947
PREVIOUS YEAR	40,37,35,187		2,40,51,059	-	-	42,76,87,746	27,60,19,508	66,41,289	51,71,108	1,19,38,293	28,79,57,801	13,97,29,947	12,77,15,679
TOTAL (A)	42,76,87,746		1,79,84,014	19,662	-	44,56,52,098	28,79,57,800	90,42,604	24,29,999	1,15,98,499	29,95,56,299	14,60,95,800	13,97,29,947
B CAPITAL W.I.P													
CENTRAL PUBLIC WORKS DEPT												12,079,991	-
TOTAL (A+B)												158,175,791	-

Note : The afforsaid expenditure is incurred out of Govt. Grants. disposal of which is subject to conditions attached to these Grants

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules Forming Part of Balance Sheet as at 31.03.2017

Schedule 9: Investments from Earmarked/ Endowment Funds (Long Term)

Amount - Rs.

Particulars	Current Year	Previous Year
1. In Government Securities	-	-
2. Other approved Securities	-	-
3. Shares	-	-
4. F.D.R. with Indian Bank (Dr. A.B. Joshi Donation)	2,50,000	2,50,000
5. Subsidiaries and Joint Ventures	-	-
6. Others (Fixed Deposits) (Dr. A.D. Agate Donation)	5,001	5,001
7. Others (Fixed Deposits from Technology Development Fund A/c:SBI & UBI)	7,94,71,865	8,04,55,702
TOTAL (Rs.)	7,97,26,866	8,07,10,703

Schedule 10: Investments - Others

Amount - Rs.

Particulars	Current Year	Previous Year
1 In Government Securities	0.00	0.00
2 Other approved Securities	0.00	0.00
3 Shares	0.00	0.00
4 Debentures and Bonds	0.00	0.00
5 Subsidiaries and Joint Ventures	0.00	0.00
TOTAL (Rs.)	0.00	0.00

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004
Schedules Forming Part of Balance Sheet as at 31.03.2017

Schedule 11: Current Assets, Loans & Advances

Amount - Rs.

Particulars	Current Year		Previous Year	
A. CURRENT ASSETS:				
1. Inventories:				
a) Stores and Spares	-		-	
b) Publications	33,565		25,860	
c) Stock-in-trade of consumables (as taken valued and certified by the Management)	6,62,749	6,96,314	90,701	1,16,561
2. Sundry Debtors:				
a) Debts Outstanding for a period exceeding six months	2,19,126		2,19,126	
	-		-	
3. Cash balances in hand (including cheques/drafts and imprest)	2,00,375	4,19,501	85,820	3,04,946
4. Bank Balances:				
a) With scheduled Banks				
- On Current Accounts	1,18,83,291		39,50,624	
- On Deposit Accounts	-		-	
- On Savings Accounts	4,16,45,542		2,14,22,048	
- On Current Accounts (TDF)	40,71,591	5,76,00,425	40,92,385	2,94,65,057
b) With non-Scheduled Banks:				
- On Current Accounts	-		-	
- On Deposit Accounts	-		-	
- On Savings Accounts	-		-	
TOTAL (A)		5,87,16,240		2,98,86,564
B. LOANS, ADVANCES AND OTHER ASSETS				
1. Loans:				
a) Staff (For HBA, Vehicle Advance and Computer)	4,06,835		8,10,816	
d) Amount receivable from Schemes	1,97,639	6,04,474	37,11,526	45,22,342
2. Advances and other amounts recoverable in cash or in kind or for value to be received :				

Particulars	Current Year		Previous Year	
a) On Capital & Revenue Expenditure	9,17,383		38,25,498	
b) Prepayments(Cash Insurance)	1,283		1,283	
c) Advances to staff (For TA etc)	2,61,453		6,78,522	
d) Prepaid Medical Insurance Premium	-		1,45,087	
e) Festival Advance	1,34,625		1,49,475	
f) Deposits kept with Govt. Agencies (MSEB, TELPHONE, GAS Cylinder etc.)	9,83,034		9,83,034	
g) Prepaid LIC	-		66,296	
h) NFCCI Workshop June 2016	-		6,375	
3. Income Accrued:		22,97,778		58,55,570
a) On Investments from Earmarked/Endowment Funds	16,38,990		14,68,242	
b) On Loans and Advances(HBA, Vehicle Adv. & Computer Adv.)	33,695		74,474	
4. Claims Receivable (TDS)	7,15,037		7,42,977	
5. Service Tax Input	9,99,896		-	
6. Kumar Krishi Mitra Fellowship	31,281		31,281	
7. Royalty Receivable	10,000		10,000	
8. Amount Receivable from MACS	3,11,712		34,044	
9. Parliamentary Standing Committee	-	37,40,611	4,11,604	27,72,622
TOTAL (B)		66,42,863		1,31,50,534
TOTAL (A+B)		6,53,59,103		4,30,37,098

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2017

Schedule 12: Income From Sales/Services

Amount - Rs.

Particulars	Current Year	Previous Year
1. Income from Sales		
a. Sales of Finished Goods (Farm Produce)	8,90,559	12,81,480
b. Sale of Raw Material	1,200	-
c. Sale of Scraps	5,10,993	-
2. Income from Services		
a. Service Charges	740	690
b. Cultural Identification Charges	14,59,207	-
c. Maintenance Services (Equipment/Property)		
d. Others	61,350	16,886
e. Fees for Information (Right to Information Act)	90	150
Total (Rs.)	29,24,139	12,99,206

Schedule 13: Grants/Subsidies

Amount - Rs.

Particulars	Current Year	Previous Year
1. Central Government	19,32,00,000	19,00,00,000
Add: Unspent balance at the beginning of the year	2,47,52,000	2,23,82,000
Less: Unspent balance at the year end	3,25,15,895	2,47,52,000
	18,54,36,105	18,76,30,000
2. State Government	-	-
3. Government Agencies	-	-
4. Institutions/Welfare Bodies	-	-
5. International Organisations	-	-
6. Others (Specify)	-	-
Net Surplus of sale of Assets		
Total (Rs.)	18,54,36,105	18,76,30,000

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2017

Schedule 14: Fees/Subscriptions

Amount - Rs.

Particulars	Current Year	Previous Year
1. Entrance Fees (Library Membership fees)	28,600	56,986
2. Annual Fees (Licence fees)/Subscriptions	14,086	13,375
3. Seminar/Program Fees	-	-
4. Others (Ph.D. Tuition fee, Ph..D.Provisional Admission fee)	1,75,120	3,31,500
Total (Rs.)	2,17,806	4,01,861

Schedule 15: Income From Investments

(Income on Invest. From Earmarked/Endowment Funds transferred to Funds.) Amount - Rs.

Particulars	Investment from Earmarked Fund		Investment -Others	
	Current Year	Previous Year	Current Year	Previous Year
INCOME FROM INVESTMENTS: (Income on Invest. From Earmarked/ Endowment Funds transferred to Funds.)				
1. Interest				
a. On Govt. Securities	0.00	0.00	0.00	0.00
b. Other Bonds/Debentures	0.00	0.00	0.00	0.00
2. Dividends				
a. On Shares	0.00	0.00	0.00	0.00
b. On Mutual Fund Securities	0.00	0.00	0.00	0.00
3. Rents	0.00	0.00	0.00	0.00
4. Others(Interest on bank deposits)	0.00	0.00	0.00	0.00
TOTAL (Rs.)	0.00	0.00	0.00	0.00
TRANSFERRED TO EARMARKED/ ENDOWMENT FUND	0.00	0.00	0.00	0.00

Schedule 16: Income From Royalty, Publications, etc.

Amount - Rs.

Particulars	Current Year	Previous Year
1. Income from Royalty	-	-
2. Income from Publications	1,055	2,035
3. Others (Sale of Tender Forms/I Cards)	17,100	27,500
4. Application Money	49,750	71,550
Total (Rs.)	67,905	1,01,085

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2017

Schedule 17: Interest Earned

Amount - Rs.

Particulars	Current Year	Previous Year
1. On Term Deposits		
a. With Scheduled Banks	35,28,487	20,66,246
b. With Non-Scheduled Banks	-	-
c. With Bank (TDF Account)	-	64,42,740
2. On Saving Accounts		
a. With Scheduled Banks	80,120	3,06,736
b. With Non-Scheduled Banks	-	-
c. Post Office Savings Accounts	-	-
d. Others M.S.E.B Deposit	-	-
3. On Loans		
a. Employees/Staff (On HBA, Vehicle and Computer Advance)	33,695	81,775
b. Interest Received on L.C	48,071	-
4. Interest on Debtors and Other Receivables	-	22,363
Total (Rs.)	36,90,373	89,19,860

Schedule 18: Other Income

Amount - Rs.

Particulars	Current Year	Previous Year
1) Profit on Sale/Disposal of Assets:		
a) Owned Assets	-	-
b) Assets acquired out of grants, or received free of cost		
2) Export Incentives realized	-	-
3) Fees for Miscellaneous Services	-	-
4) Miscellaneous Income	68,856	1,66,528
5) Guest House Receipts	99,036	40,550
6) Hostel Fees Received	48,125	20,630
7) Medical Scheme for Retired staff	2,22,000	2,28,000
8) Late Fee for Ph.D. Tuition Fee	8,600	9,000
9) Laboratory Fees	85,000	1,25,000
Total (Rs.)	5,31,617	5,89,708

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2017

Schedule 19: Increase/(decrease) in the Stock of Finished Goods & Work in Progress

Amount - Rs.

Particulars	Current Year	Previous Year
a) Closing stock		
- Laboratory Consumables	6,62,749	90,701
- Finished Goods		
- Publications	33,565	25,860
	6,96,314	1,16,561
b) Less: Opening Stock		
- Laboratory Consumables	90,701	96,396
- Finished Goods		
- Publications	25,860	25,120
	1,16,561	1,21,516
Net Increase/(Decrease)	5,79,753	(4,955)

Schedule 20: Establishment Expenses

Amount - Rs.

Particulars	Current Year	Previous Year
1) Salaries and Wages	9,32,29,955	9,13,96,265
2) Allowances and Bonus	8,01,257	8,96,674
3) Contribution to Provident Fund & New Pension Scheme	77,05,176	1,16,98,578
4) Contribution to Other Fund (D.L.I.F.)	49,175	64,516
5) Staff Welfare Expenses	39,15,512	24,60,590
6) Expenses on Employees Retirement and Terminal Benefits	94,98,052	2,21,40,421
7) Stipend to Research Students	53,07,825	66,06,155
8) Encashment of Earned Leave for LTC	2,22,303	1,44,093
9) Reimbursement of Residential Telephone Expenses	1,75,696	2,18,992
10) Fellowship & Research Associateship	22,57,573	16,16,770
11) P.F. and N.P.S. Admn. Charges	3,32,830	3,94,159
Total (Rs.)	12,34,95,354	13,76,37,213

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2017

Schedule 21: Other Administrative Expenses

Amount - Rs.

Particulars	Current Year	Previous Year
ADVERTISEMENT & PUBLICITY	3,76,786	1,99,626
AUDITORS REMUNERATION	11,500	11,500
BANK CHARGES	33,711	65,298
CAMPUS MAINT. EXPS	16,56,017	21,96,602
CASH INSURANCE	3,640	4,874
DATA BASE EXPENSES	5,025	-
ELECTRICITY & POWER	57,35,457	54,06,882
FARM HOL & SONGAON EXPS	11,44,815	6,72,011
FIELD TOUR	5,38,538	3,06,134
GARDEN EXPS	-	37,410
HIRED LABOUR CHARGES	21,61,989	20,56,925
HINDI DAY EXPENSES	5,000	-
HONORARIUM	1,54,500	1,78,500
HOSPITALITY EXPS	2,62,892	1,69,450
INFORMATION TECH & NETWORKING	6,40,421	2,22,236
LABOUR & PROCESSING EXPS	3,00,470	6,16,635
LEGAL FEES	15,000	50,000
LIB MISC EXPS	21,627	-
LIVERIES	81,680	32,576
NATIONAL TECHNOLOGY DAY EXPENSES	1,356	-
OFFICE EXPS MISC	2,39,772	1,25,128
PATENT RENEWAL CHARGES	84,000	150,200
POSTAGE, TELEPHONE & COMMUNICATION CHARGES	6,11,750	7,17,957
PRINTING & STATIONERY	9,30,258	7,51,780
PROF S P AGHARKAR DAY EXPS	1,97,521	1,57,448
PROFESSIONAL FEES	1,03,515	18,000
PROPERTY TAX	16,07,987	1602,091
PURCHASES OF CHEMICALS & GLASSWARE	1,03,79,110	92,36,237
REPAIRS AND MAINTENANCE	41,59,031	36,71,050
SCIENCE DAY EXPS	-	2,250
SCIENCE EXHIBT. EXP.	2,01,000	2,44,442

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2017

Amount - Rs.

Particulars	Current Year	Previous Year
SECURITY SERVICE CHARGES	13,93,179	16,81,339
SEMINAR EXPS	27,000	59,500
SERVICE TAX PAYMENT (NET)	4,08,406	9,93,193
SUBSCRIPTION EXPS	16,67,978	50,12,830
TA/CONVEYANCE--INDIAN AND FOREIGN TOUR	12,74,115	5,71,169
UNIVERSITY AFFILIATION FEES	3,32,000	-
VEHICLE RUNNING AND MAINT EXPS	1,52,419	1,76,055
VIGILANCE WEEK	1,000	-
PUBLICATIONS	1,41,639	3,75,410
WATER CHARGES	7,01,154	8,76,475
TOTAL (Rs.)	3,77,63,257	3,86,49,213

Schedule 22: EXPENDITURE ON GRANTS, SUBSIDIES ETC.

Amount - Rs.

Particulars	Current Year		Previous Year	
a) Grants given to Institutions/ Organisation	0.00	0.00	0.00	0.00
b) Subsidies given to Institutions/ Organisations	0.00	0.00	0.00	0.00
TOTAL (Rs.)	0.00	0.00	0.00	0.00

Note : Name of the Entries, their Activities along with the amount of Grants/
Subsidies are to be disclosed.

Schedule 23: INTEREST

Amount - Rs.

Particulars	Current Year		Previous Year	
a) On Fixed Loans	0.00	0.00	0.00	0.00
b) On Other Loans (including Bank Charges)	0.00	0.00	0.00	0.00
c) Others (Specify)				
TOTAL (Rs.)	0.00	0.00	0.00	0.00

M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004

Schedules Forming Part of Balance Sheet as at 31.03.2017

Schedule D: Transfer to Capital Fund

Amount - Rs.

Particulars	Current Year		Previous Year	
Other Fixed Assets				
Books	8,36,316		6,99,115	
Buildings	2,71,616		59,09,600	
Computer / Peripherals / Softwares	33,54,776		46,55,896	
Office Furniture & Dead Stock	10,01,527		2,50,901	
Other Fixed Assets	8,70,935		-	
App. & Equipments	1,16,48,844		1,25,35,547	
		1,79,84,014		2,40,51,059
Advance to Supplier for Equipments (Considered in Capital W.I.P for F.Y 2016-17)				
C. DAC -			1,58,673	
CPWD -			9,50,926	
Easy Comp Solutions	-		11,250	
FlyJac Logistics	-		3,52,516	
Freight Express	-		1,58,349	
Mapple ESM Technologies Ltd.	-		1,21,500	
PSP Freight Lines Pvt.Ltd.	-		1,51,405	
LEICA Microsystems	-		1,450	
ESCO Micro Pvt Ltd., Singapore	-		3,05,348	
Ingram Micro India Pvt. Ltd.	-		16,14,081	
				38,25,498
TOTAL		1,79,84,014		2,78,76,557

As per our report of even date
For **M/S SPAY & CO**
Chartered Accountants
FRN:132976W

Sd/-
FINANCE & ACCOUNTS OFFICER
MACS A.R.I.

Sd/-
OFFICIATING DIRECTOR
MACS A.R.I.

Sd/-
PARAS MUNOT
Partner
MRN:142148

Place: Pune
Date: 21/7/2017

FORM OF FINANCIAL STATEMENTS: Non –profit making organization
 Name of Entity: M.A.C.S'S AGHARKAR RESEARCH INSTITUTE, PUNE - 411 004
 Schedules forming part of the Accounts for the period ended 31.3.2017

Schedule 24: Significant Accounting Policies

a. Accounting Convention :

The Financial statements are prepared under the historical cost convention and in accordance with the applicable Accounting Standards except where otherwise stated. Accrual system of accounting is generally followed to record the transaction in the financial statements.

b. Fixed Assets :

Fixed assets are stated at their original cost of acquisition, less depreciation.

c. Method of Depreciation:

Depreciation on fixed assets has been provided on straight line basis (SLM) as per the rates prescribed under the Bombay Public Trust Act, 1950.

It is not possible for us to verify the actual date of asset put to use and hence the same has been taken on the basis of information and explanation given by the management. Accordingly depreciation is calculated irrespective of put to use for the whole year.

d. Extra-ordinary Items, Prior Period Items, Changes in Accounting Policies :

On the basis of information and explanation given by the management Extra-ordinary Items, Prior Period Items, Changes in Accounting Policies are separately disclosed in the financial Statement but are integrated through various items appearing under the same.

e. Foreign Currency Transactions:

Transactions denominated in foreign currency are accounted as the exchange rate prevailing at the date of the transaction; however foreign exchange gain loss is not calculated and accounted for.

f. Investments:

1. Long term investments are valued at cost and where required, provision is made for permanent diminution in the value of such investment.
2. Investment classified as "Current" is valued at cost and market value.
3. Cost means acquisition cost which includes acquisition expenses like brokerage, transfer stamp, etc.

g. Revenue Recognition:

1. All Revenue receipts are on accrual basis.
2. All Expenses are generally accounted for on accrual basis.

h. Accounting for Government Grants:

1. Government grants of the nature of contribution towards capital cost of setting projects as capital reserve

2. Grant in respect of specific assets acquired is shown as a deduction from the cost of related assets.
3. Government grants/subsidies are generally accounted on accrual basis.
4. Government grants are taken for seminars in revenue nature but directly taken to Current asset and expenditure is booked against it so as to determine shortage or excess if any.

i. Retirement Benefits:

1. Generally, liability towards gratuity payable on death/retirement and leave encashment of the employees is provided based on Actuarial Valuation.
2. Provision for accumulated leave encashment benefit to the employees is accrued and computed on the assumption that the employees are entitled to receive the benefit as each year end which is also done on Actuarial Valuation.

j. Capitalization:

All direct expenses attributable to fixed asset acquired are capitalized.

As per our report of even date
For **M/S SPAY & CO**
Chartered Accountants
FRN:132976W

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FORM OF FINANCIAL STATEMENTS: Non –profit making organization
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 Schedules forming part of the Accounts for the period ended 31.3.2017

Schedule 25: Contingent liabilities and Notes on Accounts (Illustrative)

1. Contingent liability:

- a) Claims against the entity not acknowledge as debts- Nil (Previous Year- Nil)
- b) In respect of:
 - Bank guarantee given by on behalf of the entity -N.A.(Previous Year- Nil)
 - Letters of credit opened by bank behalf of the entity - Nil(Previous Year-Rs. Nil)
 - Bill discounted with banks - Nil (Previous Year- Nil)
- c) Disputed demands in respect of:
 - Income tax - Nil (previous Year- Nil) Sales tax - Nil (Previous Year- Nil)
 - Municipal Taxes - Nil (Previous Year- Nil)
- d) In respect of claims from parties for non-execution of orders, but contested by the entity Nil (Previous Year- Nil)

2. Capital Commitments:

Estimated value of contracts remaining to be executed on capital account and not provided for (Net of Advances)- Nil (Previous Year)- Nil

3. Lease obligation:

Further obligation for rental under finance lease arrangements for plant and machinery is Nil (previous Year)- Nil

4. Current Assets, Loans and Advances:

In the opinion of the management, the current assets, loans and advances have a value on realization in the ordinary course of business, equal to the aggregate amount shown in the Balance Sheet. Some of balance of sundry debtors, deposits, loans and advances are subject to confirmation from the respective parties and consequential reconciliation adjustments arising there from, if any.

5. Taxation:

In view of there being no taxable income under Income Tax Act 1961, No provision for income tax has been considered necessary. In view of this, no disclosure is required as per accounting standards -22 issued by The Institute of Chartered Accountants of India (ICAI).

6. Grants:

During the year, The Institute has received revenue as well as capital grants from government. The accounts of such grants are disclosed in financial statements as per AS-12 issued by Institute of Chartered Accountants India (ICAI) except grants which are received from DST for meetings/seminar which are of revenue nature are routed through Balance Sheet rather than Income & Expenditure.

7. Retirement Benefit:

Generally, liability towards gratuity payable on death/retirement of employees is provided based on Actuarial Valuation and provision for accumulated leave encashment benefit to the employees is accrued and computed on the assumption that employees are entitled to receive the benefit at each year end which is also done on Actuarial Valuation.

The principle assumption used in determining the gratuity obligation are as below:-

Sr. No.	Particulars	For year ended 31 st March, 2017
1.	Withdrawal Rate	2.00%
2.	Discounting Rate	7.27%
3.	Future Salary Rise	5.00%

The position of gratuity payable on death/retirement of employees and leave encashment as on 31st March, 2017 is as below

Particulars	Provision for Gratuity	Provision for Leave Encashment
Opening balance as on 31 st March 2016	6,30,36,823	4,74,06,282
Add:- Addition during the year 2016-17	37,882
Less:- Deduction during the year 2016-17	6,60,792
Closing Balance as on 31 st March 2017	6,23,76,031	4,74,44,164

8. Impairment of Assets:

As per Accounting Standard-28 "Impairment of Assets" issued by the institute of Chartered India, comes in to effect, in respect of accounting commencing on or after 1st April, 2005. We have relied upon the management on the matters related to impairment of assets, in view of management there are no impairment losses.

9. Previous year figure are rearranged, recast or regrouped wherever necessary, to make them comparable which those of the year under audit.
10. Third party confirmation is necessary for confirming the balances appearing in the books of account and also long outstanding of balances as at the Balance Sheet date, but institute was not able to provide any of such confirmation to us. Hence, we are unable to comment on the accuracy of such third party balances.
11. Provisions are recognized when the firm has present obligation as a result of past event; it is more likely that an outflow resources will be required to settle the obligation; and the amount has been reliably estimated.
12. In case of items debited to Income and Expenditure account, it was informed to us that the expenditure is not of capital nature.
13. Depreciation on fixed assets has been provided on straight line basis (SLM) as per the rates prescribed under the Bombay Public Trust Act, 1950.

As per our report of even date
For **M/S SPAY & CO**
Chartered Accountants
FRN:132976W

Sd/-
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MACS A.R.I.

Sd/-
PARAS MUNOT
Partner
MRN:142148

Place: Pune
Date: 21/7/2017

Cultural Programme

3 August 2016

Students participated enthusiastically in various activities including dance, skits, rangoli and poster making.



MACS



**Maharashtra Association for the Cultivation of Science
Agharkar Research Institute**

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