Annual Report 2017-18

MACS

Maharashtra Association for the Cultivation of Science
Agharkar Research Institute

ARI

Vision

To excel as an internationally recognized centre of multi-disciplinary research in science and technology

Mission

a) Conduct basic and applied research in life and related sciences for human betterment

b) Explore the genetic diversity of microbes, plants and animals

c) Develop sustainable technologies for a cleaner environment, agriculture and better health

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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 2017-18. I would like to highlight some of the achievements in research and the society oriented activities. The detailed report, in the following pages, gives an elaborate account of the work done by MACS-ARI.

Biodiversity studies have led to the hosting of Digitized Inventory of Medicinal Plant Resources of Maharashtra (mpd.aripune.org) on the ARI website. The website mpd.aripune.org was released at the hands of the Honourable Chief Minister of Maharashtra, Shri Devendraji Fadnavis. A book Important Medicinal Plant Resources of Maharashtra, based on the database observations, was published.

Studies in Bioenergy have led to the development of a biocontrol method for the inhibition of sulfate reducing bacteria (SRB) and SRB associated souring of petroleum reservoirs. It is effective, inexpensive and environmentally benign.

We have come up with the twelfth wheat variety namely MACS 4028 (durum) for rainfed-timely sown condition in Peninsular Zone. It was notified in the 79th meeting of central sub-committee on crop standards, notification and release of varieties.

One hundred and sixty-five quintals of wheat breeder seed and two hundred and seventy quintals of soybean breeder seed was supplied to seed multiplying agencies and farmers.

A notable achievement in Nanobioscience concerns Nano-Amphotericin B (Nano-AmB), which is a safer antifungal drug with good biocompatibility and solubility. It is found to be effective in controlling standard and clinical strains of the human pathogenic fungus *Candida albicans, in vitro,* at half the dose of the bare drug and the commercial formulation.

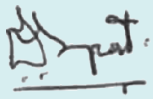
Having mentioned a few highlights in research, I will now touch upon the memorial orations and society oriented activities.

The memorial lectures organised by MACS-ARI included the Dr GB Deodikar Memorial Oration on Earth System Science by Prof. Dr Nitin R Karmalkar, Vice-Chancellor, Savitribai Phule Pune University; Shri GB Joshi Memorial Oration on Molecular Marker Assisted Selection For Wheat Improvement by Dr. KV Prabhu, Joint Director (Research), ICAR-IARI, New Delhi and the 57th Prof. SP Agharkar Memorial Oration on Navigating Scientific Complexity by Common Sense by Prof. Dr Ashutosh Sharma, Secretary to the Government of India, Ministry of Science and Technology, Department of Science and Technology, New Delhi.

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.

The popularity of MACS' scientific promotion programmes like home gardening and field botany continues to grow. Enthusiasts in home gardening and plant taxonomy have been benefitting from the courses.

To conclude, MACS-ARI has had yet another fruitful year.



DR Bapat
29 June 2018

EXECUTIVE SUMMARY

Dr KM Paknikar
Director (Officiating)
Agharkar Research Institute
Pune

Dear Readers,

This annual report brings to you several interesting achievements at Agharkar Research Institute. I am happy to mention that the efforts in making the research visible are bearing fruits. The average impact factor of ARI research papers is 3.184. Out of the seventy research papers published, fifty-four have appeared in SCI journals.

The outcome of the research activities is a result of the well planned restructuring of the research areas into six thematic areas, in the past five years.

I am pleased to highlight a few achievements, which are presented theme-wise.

Biodiversity and Palaeobiology

Multiple genera of mesophilic methanogens were isolated from rumen and faecal samples of herbivorous animals, termite gut and pond sediments, while thermophilic methanogens were isolated from hot spring sediments collected from Maharashtra, and Jammu & Kashmir.

Tamhinispora srinivasanii, a new fungal species was collected from the Western Ghats of Maharashtra, India. Fungi *Moorella heterosporous, Helicoma eucalyptii, Helicosporium mirticearum* and *Helicosporium xylophilus* were found as new species. Fungus *Helicosporium lindri* has been recorded as a new record for India.

Biological fungicide can be a good option against chemical fungicide in the prevention of powdery mildew in grapes. We have found the culture filtrate of *Ampelomyces, Trichoderma* and *Sachharomyces* suitable for control of powdery mildew.

Lichens have been collected from Garhwal division of Uttarakhand. These include species belonging to *Parmeliaceae*, *Peltigera*, *Cladonia*, exclusive alpine species of *Stereocaulon* and rare species *Menegazzia terebrata* and *Hypogymnia physodes*.

A new species of angiosperm *Eriocaulon parvicephalum* was discovered from district Sindhudurg of Maharashtra.

South India and North-East India are hypothesized to be the 'center of speciation' for many *Capparis* species. Molecular phylogenetic tools are being used to understand morphological evolution and ecological diversification of the forest dwelling capers in Indian subcontinent.

Members of the diatom genus *Pseudostaurosiropsis* are known only from Northern America and Europe. The first report of *Pseudostaurosiropsis* in Asia highlights the need of studying biodiversity outside the protected area. Fifteen new species of the diatom *Stauroneis* were reported from the Western Ghats.

Ichnology of the Upper Jurassic rocks of the Marwar Basin, Rajasthan has shown the transition from *Zoophycos* ichnofacies (lower member) through *Cruziana* to *Skolithos* (middle member) to *Cruziana* (upper member), which suggests a shift in depositional environments.

Four different gene genetic types in intertidal benthic foraminifera genus *Ammonia* have been identified from Rajpuri creek, Maharashtra using integrated morphological and molecular approach.

Bioenergy

The microbial consortium 101C5 was found to be suitable for recovery of residual oil from different reservoir types.

A biocontrol method for the inhibition of sulfate reducing bacteria (SRB) and SRB associated souring of petroleum reservoirs is developed. It is effective, inexpensive and environmentally benign.

A process developed for the biomethanation of rice straw has resulted in enhanced methane (up to 75 %) and low carbon dioxide content, low accumulation of volatile fatty acids, and faster degradation of different lignocellulosic components.

Bioprospecting

Cardioprotective and anticancer potential of two lichenized fungi *Everniastrum cirrhatum* and *Parmotrema reticulatum* from Western Ghats is being explored.

The ability of a fluorescent copper probe, OBEP-CS1, to inhibit intracellular oxidative stress associated with an amyloid β (Aβ) peptide-copper complex is being studied with reference to etiology of neurodegenerative diseases, including Alzheimer's disease (AD), amyotrophic lateral sclerosis, Parkinson's disease, and prion disease.

In the work on Alzheimer's disease (AD) it was found that thiosemicarbazone moiety assists in interaction of planar aromatic molecules with amyloid beta peptide and acetylcholinesterase.

Besides, antitubercular activity of rugosaflavonoid derivatives, and estrogenic and antiestrogenic activity of naturally occurring molecules for treating breast cancer are under study.

Developmental Biology

In an attempt to introduce evolutionary developmental biology (Evo-Devo) model for school, undergraduate and post-graduate teaching in India, hydra from different localities in the country is being studied.

While studying the role of autophagy in germline stem cell maintenance and ageing in *Drosophila*, we expect to uncover a network between autophagy, growth signaling and mitochondrial reactive oxygen species that regulate germline stem cells maintenance and aging.

We are studying in *Drosophila* how glial organization and morphology are regulated in the embryonic central nervous system.

Based on small-scale quantitative mRNA expression data of ECM coding genes, we have identified that extracellular matrix gene 1(*ecm1*) is induced in the regenerating zebrafish heart.

Genetics and Plant Breeding

Soybean variety MACS 1460 was identified for release by the varietal identification committee for release in the states of West Bengal, Jharkhand, Chhattisgarh, Orissa, Assam and North Eastern states, Southern Maharashtra, Karnataka, Telangana, Andhra Pradesh and Tamil Nadu.

To popularize grape variety ARI-516 cuttings and saplings were sold to grape growers in Maharashtra for cultivation.

Nanobioscience

Experiments using zinc oxide nanoparticles have indicated their beneficial effect in diabetic dyslipidemia.

We developed a conformationally constrained cyclic β-sheet breaker peptides using an unnatural amino acid and a disulfide bond as a therapeutic intervention for Alzheimer's disease.

We are working on target specific nanoconstructs for siRNA delivery in prostate cancer cells and find that PAMAM-Histidine-PEG-Triptorelin could be a promising approach for specific gene silencing in LHRH overexpressing cancer cells.

Our study on the importance of thrombin and Factor Xa in Hepatitis E virus replication sheds light on the presence and roles of clotting factors with respect to virus replication in the cells.

Research on antimicrobial activity and biocompatibility of nanosilver deposited dental abutments has shown that nanoscale silver deposition prevented initial microbial adhesion thereby improving soft tissue integration of implant.

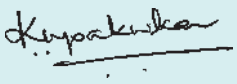
While elucidating the molecular mechanisms underlying the uptake of Zn from foliar applied nanoparticles the analysis of grain endosperm proteins showed enhancement of gamma gliadins while other gluten subunits decreased.

Five students were awarded the PhD degree, and fifty-seven students are working for their PhD degree.

ARI participated in the Exhibition on Science and Technology Innovations meant for Members of Parliament, at the Parliament Annexe.

A training programme was conducted for teachers of secondary schools. A public outreach day was conducted for secondary school students. Details on the outreach and extension activity of ARI are available in the annual report.

It would suffice to say that the institute contributed significantly in both research, and extension activity.



KM Paknikar
29 June 2018

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

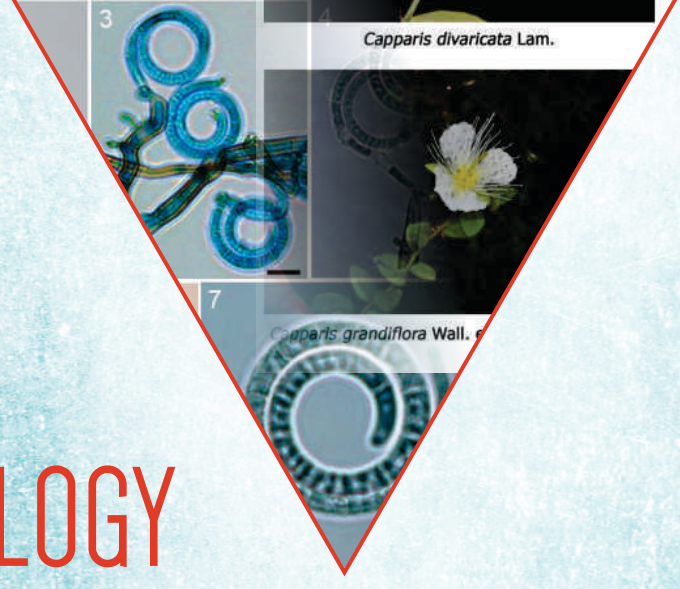
Dr Karthick Balasubramanian

Dr Rajesh Kumar KC

Dr Abhishek Baghela

Dr Mandar N Datar

Dr Tushar Kaushik



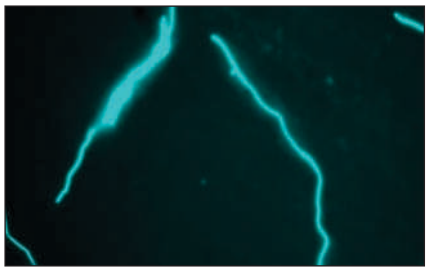
BIODIVERSITY AND PALAEOBIOLOGY

Studies under this thematic area focus on investigation of the entire range of life forms including viruses, archaea, bacteria, fungi, lichens, diatoms, plants, and fossil forms.

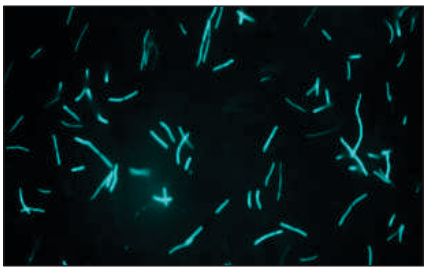
Archaea, Bacteria

Cultivation of multiple genera of mesophilic and thermophilic methanogens

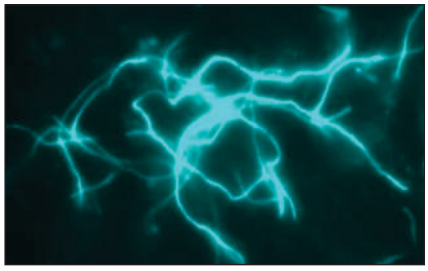
Multiple genera of mesophilic methanogens were isolated from rumen and faecal samples of herbivorous animals, termite gut and pond sediments, while thermophilic methanogens were isolated from hot spring sediments collected from Maharashtra, and Jammu & Kashmir. Sixty-two cultures belonging to different species of *Methanobacterium*, *Methanoculleus, Methanosarcina, Methanothermobacter, Methanobrevibacter* and *Methanocorpusculum* genera were obtained (Figure 1). Based on the 16S rRNA gene sequencing results, three cultures of termite, green iguana, and hot spring origin can be putative novel species of methanogens, while one putative novel genus was recorded from Indian star tortoise.



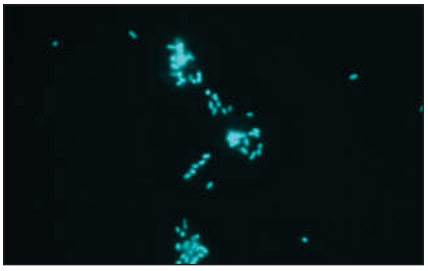
Methanospirullum hungatei



Methanobacterium formicicum



Methanothermobacter marburgensis



Methanocorpusculum aggregans

Figure 1
Fluorescence microscopic images of some methanogen isolates

Fungi

Biodiversity, classification and conservation of fungi

During biodiversity study of fungi a new species of *Tamhinispora* (Figure 2) was collected from the Western Ghats of Maharashtra, India. This monotypic genus, belonging to *Tubeufiaceae*, was established based on the type species *T. indica*, collected from Tamhini Ghats of western India. The new species differs from the type species based on key characteristics, such as branched or Y-shaped conidial body and presence of arm-like conidial appendages. Single conidial cultures were developed and sporulation was established on MEA media following a long period of incubation. Phylogenetic analyses using ITS and LSU sequence data confirmed the position of *T. srinivasanii* along with *T. indica* in the *Tamhinispora* clade in Tubeufia (Figure 2).

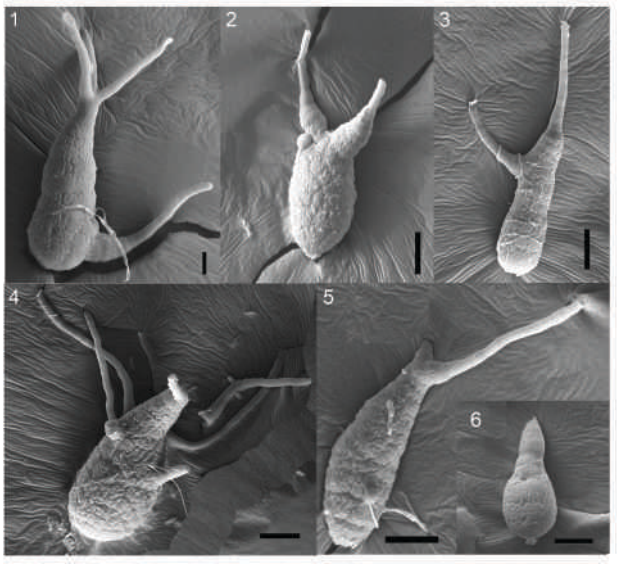


Figure 2
Scanning electron micrographs
Tamhinispora srinivasanii

Similarly during exploration of pathogens of various types of trees, dead wood, leaf litter, soil, and dead wood etc. from the forests of Western Ghats of Maharashtra, were collected. Samples from outside and inside of the dead bark of Nilgiri (*Eucalyptus*) and from other dead wood were collected from different types of fungal genera such as *Moorella, Helicoma* and *Helicosporium*. On the basis of detailed morphological, comparative and intensive study, various fungal species such as *Moorella heterosporous, Helicoma eucalyptii, Helicosporium mirticearum* and *Helicosporium xylophilus* were found as new species. Another fungal species was discovered and this was isolated successfully in vitro by using single spore

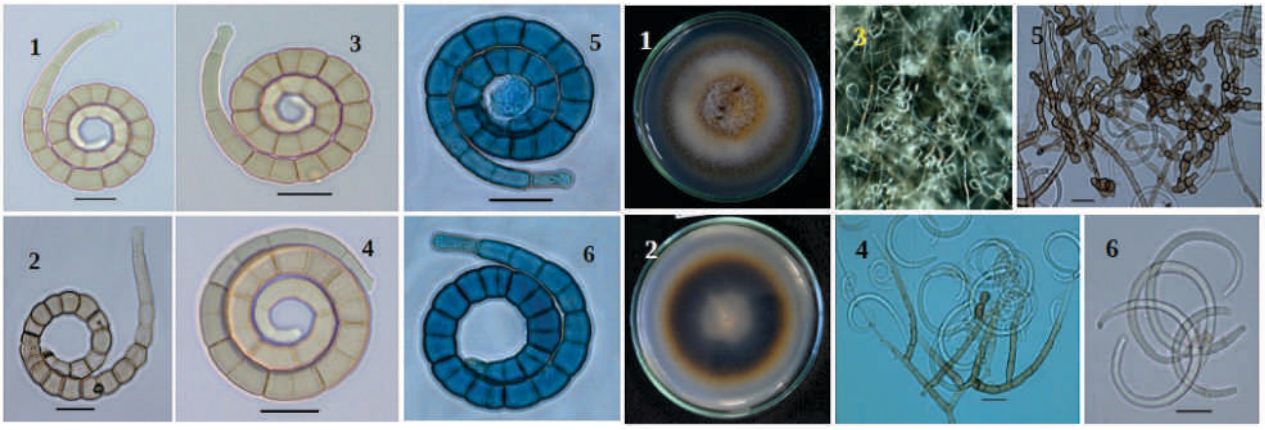


Figure 3
Helicosporium linderi from *Eucalyptus* bark and its helicoid spores, conidiophore and colony morphology on culture media, conidia and conidiophores in cultures

isolation technique. This fungus was identified as *Helicosporium linderi* on the basis of morphological and molecular studies. Based on the review and analysis, it has been recorded as a new record for India (Figure 3).

Studies on plant pathogenic fungi

Members of the genus *Fusarium* are well known for their pathogenic and/ or toxicogenic capability. One hundred and thirty-two *Fusarium* isolates were selected and subjected to morphological and molecular characterization. The recommended ITS-rDNA, EF-1α and LSU genes were sequenced for elucidating identity and phylogenetic relationships. Phylogenetic analysis based on multigene sequencing revealed the identity and formed clearly distinguishable clusters belonging to eight diverse species complexes like *Oxysporum, Fujikuroi, Sambucium, Incarnatum-Equiseti, Decemcellulare, Solani, Chlamydosporum* and *Nisikadoi.* In the complete study, 22 species of *Fusarium* were found.

A multi-locus microsatellite typing method for studying the genetic diversity and possible genotype-host correlation in *Colletotrichum gloeosporioides* was developed. *C. gloeosporioides* isolates from *Ocimum sanctum*, *Capsicum annuum* (chilli pepper), and *Mangifera indica* (mango) formed distinct clusters, therefore exhibited some level of correlation between genotypes and host. This method would be useful when breeding for resistance or monitoring the sensitivity of fungicides across a collection of well-defined isolates.

Studies on biocontrol of powdery mildew on grapes

The use of chemical fungicide is more prevalent now in the prevention of powdery mildew in grapes. Biological fungicide can be a good option for chemical fungicide. We have found *Ampelomyces, Trichoderma* and *Sachharomyces* suitable for control of powdery mildew. The spread of powdery mildew of grapes was prevented using culture filtrate of these fungi (Figure 4).

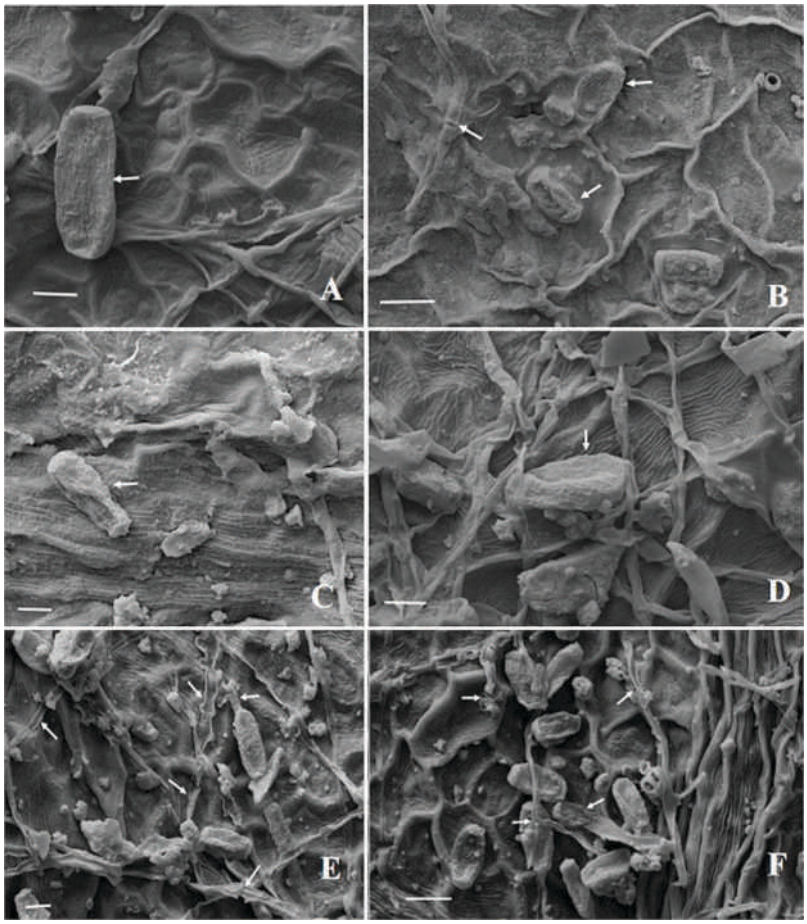


Figure 4
Study by using scanning electron microscopy A Control leaf showing normal hyphae and conidia B-F Treated leaves showing cracking of hyphae and shrinkage of conidia

Lichens

Lichens have been collected from Garhwal division of Uttarakhand. Area under survey was Govindghat, Ghangaria, Hemkunt, Badrinath, Mana, Auli and Gorson Top situated at various higher altitudes (ranges from 2400m to 4200m); in order to find out richness of bioactive compounds in lichens, both quantitatively and qualitatively.

Morpho-anatomy and chemotaxonomic studies of over 75 specimens belonging to the different groups of lichens have been studied. Specimens identified up to 47 species; of which 11 species belongs to family *Parmeliaceae*, 8 species of *Peltigera*, 6 species belongs to *Cladonia*, exclusive alpine species of *Stereocaulon* species *(S. alpinum, S. macrocephalum, S. himalayense*, *S. foliolosum*, *S. piluliferum*), 5 crustose (*Aspicilia, Lobothallia, Lecanora, Rhizocarpon, Rhizoplaca*), and 2 belongs to *Ramalina*, *Heterodermia*, *Sticta*, *Lobaria, Xanthoria* each. Rare species *Menegazzia terebrata, Hypogymnia physodes* also found.

Plants

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

Eriocaulons (Pipeworts) have the 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. Out of a total 350 accessions, collected from the Western Ghats and Eastern Himalayas, 60 species of the genus were identified after critical morphological examination. SEM studies on *Eriocaulon* seeds and floral parts were carried out for 11 species. DNA isolation was done, and three molecular markers namely ITS, *psbA-trnH*, and *trnL-F* regions were amplified and 70 new sequences were generated. Preliminary phylogenetic analysis was carried out using Maximum Likelihood and Bayesian algorithms. Ancestral state reconstruction was carried out using software Mesquite. A new species *Eriocaulon parvicephalum,* Darsh., RK Choudhary, Datar and Tamhankar discovered from Sindhudurg District of Maharashtra, was published in Phytotaxa (Figure 5).

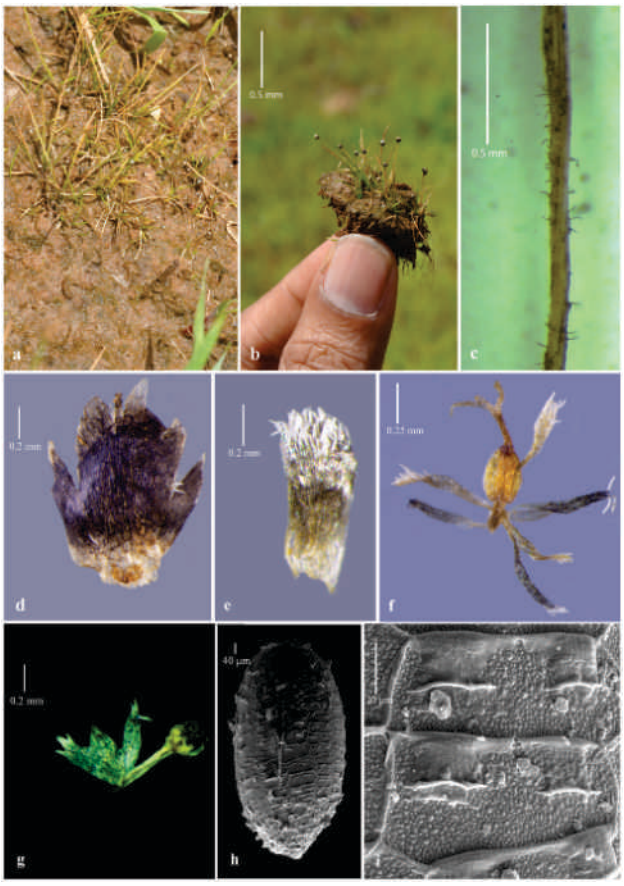
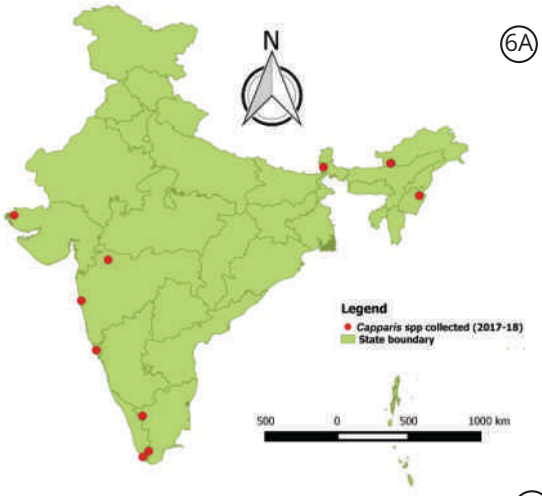


Figure 5
Eriocaulon parvicephalum, a new species discovered from Northern Western Ghats, India

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 31 species and 3 subspecies with distribution ranging from dry deciduous to evergreen forest types. South India and North-East India are hypothesized to be the 'center of speciation' for many *Capparis* species. Studies are being carried out to understand morphological evolution and ecological diversification patterns of *Capparis* species from Indian subcontinent. Floristic surveys were conducted in Maharashtra, Gujarat, Tamil Nadu, Kerala, Manipur, Meghalaya, Assam, Arunachal Pradesh, and W. Bengal (Figure 6A). Total 140 accessions of *Capparis* comprising of 20 species were collected from different parts of India. For molecular studies, DNA extraction was done for all species and amplification of 15 species with chloroplast markers (*psbA-trnH*, *MatK*, *trnL-F*, *rbcL*) and nuclear internal transcribed spacer (ITS) region have been completed. Congruence of molecular sequence data and morphological characters is being assessed to understand morphological character evolution (Figure 6B).



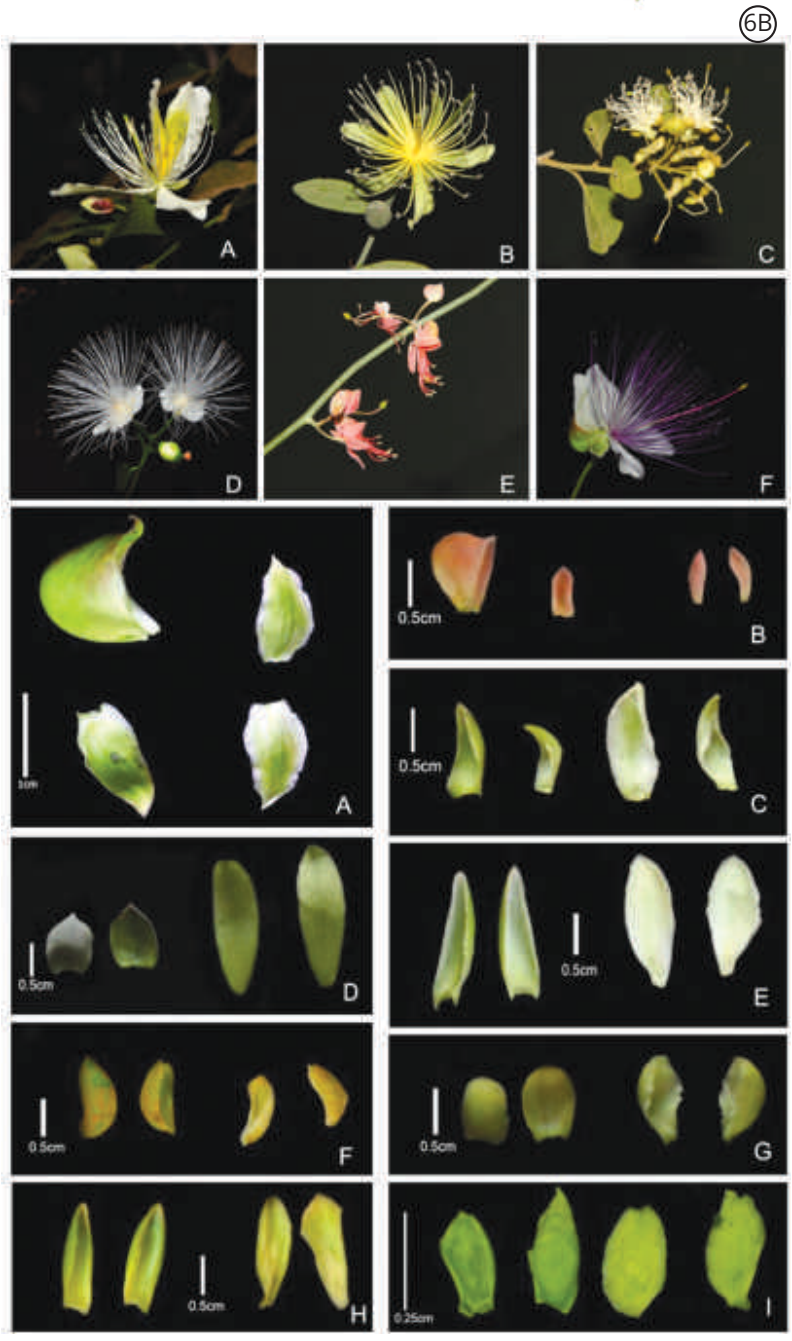


Figure 6

A. Map of India showing point localities where surveys were conducted

B. Floral parts of Capparis species collected across India

Unravelling the vascular plant endemism of Northern region of Western Ghats

Rock outcrops are one of the unique habitats experiencing environmental extremities and supporting vegetation with high endemism and interesting adaptive strategies. Structurally, they are the parts of exposed bedrock that include landforms ranging from inselbergs, plateaus, cliffs, isolated hills and platforms. They experience water logged conditions in the wet season and desiccation in the dry season. As a result, seasonal herbaceous plant cover is found on this habitat. It is a plant life between inundation and desiccation, every year shifting from flooding to water shortage. The plant species are known to have certain ecological strategies so as to cope up with extreme environments and short life cycle. We are presently addressing questions related to biodiversity such as species area relationships, seasonal and temporal changes, patterns of rarity and endemism. 13 rocky plateaus in Northern Western Ghats were surveyed using transect cum quadrat method during the monsoon of 2017 with documentation of 128 species (Figure 7).

Figure 7
Diversity of endemic angiosperms in Northern Western Ghats

Muraina-grasses of India: Addressing the polymorphism and interspecific variation through morphological, ecological and molecular phylogenetic studies

The genus *Ischaemum* is one of the most variable amongst grasses showing greatest complexity and diversity. Globally its distribution is concentrated in South-East Asia, especially in India. In India, highest species diversity in this genus is found in Peninsular India especially in the Western Ghats. However, some species are also distributed in North-East India and Gangetic plains. 73% of Indian *Ischaemum*

species are endemic to the country. Floristic workers find the identification of the species of *Ischaemum* very problematic. Efforts are being made to understand this complex genus through morphological, ecological and molecular phylogentic studies. A total of 180 accessions collected across India are being worked out presently (Figure 8).

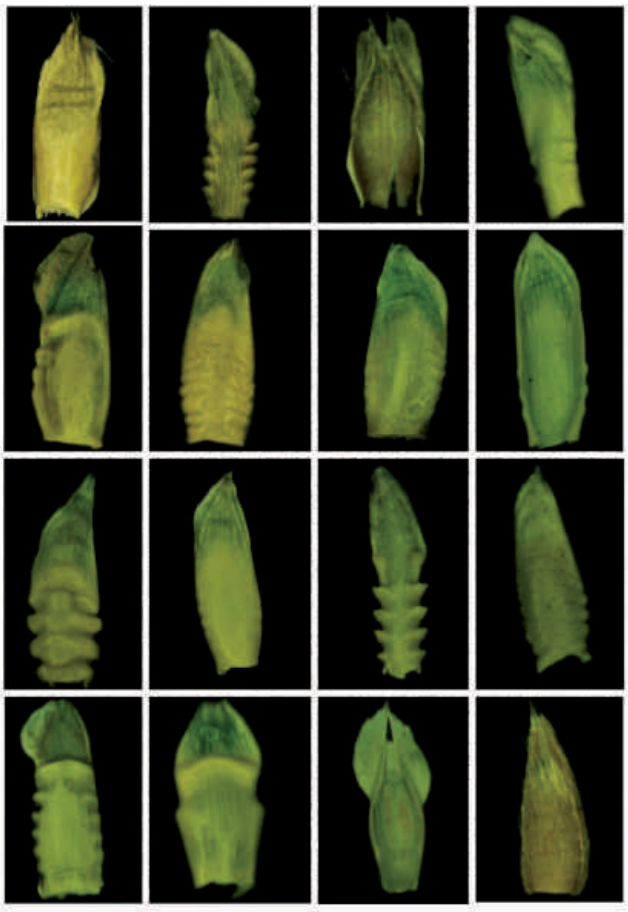


Figure 8
Diversity of lower glume architecture in genus *Ischaemum*

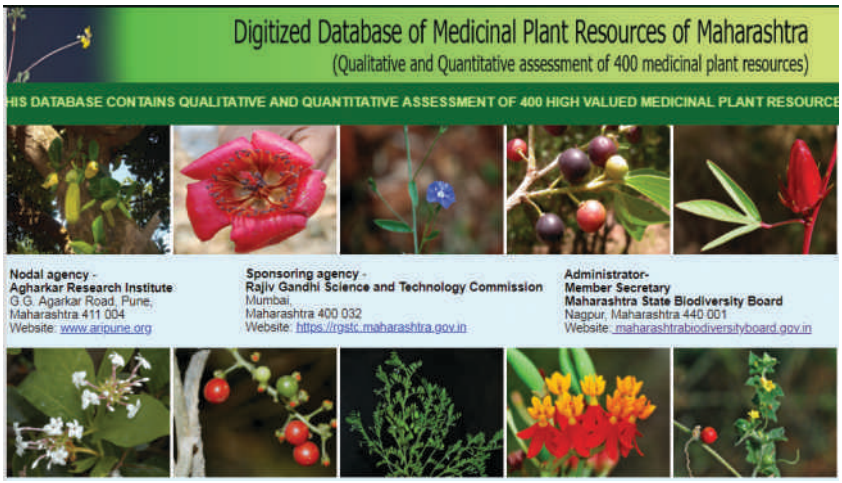
Conservation of selected endemic species of orchids of Northern Western Ghats through *ex-situ* multiplication and reintroduction in the wild

Orchidaceae represents one of the most successful families of flowering plants with around 25,000 species distributed worldwide. Orchids are sensitive to minute changes in their environment, as these changes directly affect survival and germination ability of orchids. As a consequence of current industrialization and development taking place in the Western Ghats, habitat loss has resulted in depleting diversity of rare and endemic orchid species. We are dealing with the conservation of 10 indigenous orchid species through micro-propagation by focusing on mass multiplication with the help of plant tissue culture techniques (Figure 9). Re-introduction of these orchids will be done in the wild ensuring effective *in situ* conservation of orchid germplasm.

Figure 9
Micro-propagation of endemic orchids in the Western Ghats

Launch of the medicinal plant database

A database entitled 'Digitized Inventory of Medicinal Plant Resources of Maharashtra' has been hosted on the website of Agharkar Research Institute, Pune and the website mpd.aripune.org was released by the Honourable Chief Minister of Maharashtra, Shri Devendra Fadnavisji (Figure 10). A total of 400 medicinally important resources were inventoried. Of these, 157 commercially high valued species were actually mapped using standard ecological methods by random selection of 1710 locations belonging to 290 talukas of 34 districts of Maharashtra. Efforts were also made to collect information on quantitative assessment of demand and supply of these resources. Trade data on 104 species with reference to market availability, price range and industrial demands were also gathered.



The database observations were critically analyzed and the printed version 'Important Medicinal Plant Resources of Maharashtra' was published.

Figure 10
Homepage of mpd.aripune.org

Development and validation of HPTLC fingerprints of *Alpinia*

Alpinia galanga (L.) Willd. (*Rasna* or Greater galangal or *Kulinjan*) is used as mutagenic and anti-inflammatory. Due to the high demand *A. galanga* is substituted with rhizomes of *A. calcarata* and *A. officinarum*. We have developed a rapid and reproducible HPTLC method, which is useful for routine analysis of galangin and quality control.

The mobile phase, hexane: ethyl acetate: acetic acid (6.2: 2.8: 1.0 v/v/v) gave optimized result with sharp, symmetrical and well resolved peaks of galangin at Rf 0.42 from other components of the sample extracts (Figure 11B). A linear relationship was obtained between response (peak area) and amount of galangin in the range of 50-250 ng/band; the correlation coefficient was 0.9919 (Figure 11A). A biomarker galangin in the

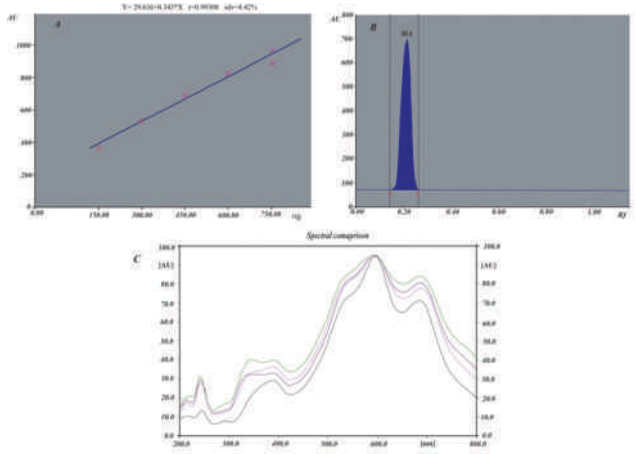


Figure 11
A Linear range of calibration plots for galangin
B Standard galangin used as a phytomarker C Overlaid spectra of standard galangin and three species of Alpinia

methanolic extracts of three species of Alpinia was quantitated using the developed HPTLC method. The trend of galangin was found to be as A. galanga (7.67 ± 0.36 mg/g) > A. officinarum (5.77 ± 0.71 mg/g) > A. calcarata (4.31 ± 0.44 mg/g) (Figure 11C).

Development of crude drug repository of genuine botanical resources

Enrichment of the repository by addition of genuine botanical resources from Maharashtra is being done. Addition of 228 samples from different locations of five regions was achieved. The documentation of plant part used as medicine using pharmacopoeial parameters in fresh and dry form, images of habit and crude drug, physicochemical parameters like ash and extractive analysis is being done.

Unravelling the biodiversity of anthropogenically impacted urban wetlands

Urban ecosystems are novel type of ecosystems that provide natural laboratories for examining processes of colonization, primary succession, and community assembly in the line of anthropogenic disturbances. During our ongoing study on understanding the diatoms in human impacted regions, we came across a potentially new araphid diatom *Pseudostaurosiropsis* species from an urban lake in Mumbai Metropolitan area (Figure 12). Further, this is the first report of the genus *Pseudostaurosiropsis* in Asia. Till date member of this genus are known only from Northern America and Europe. This study highlights the need of studying biodiversity outside the protected area.

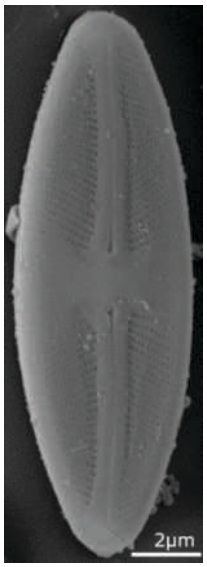
△

Figure 12

Pseudostaurosiropsis sp. from the Powai Lake, Mumbai

Taxonomy and biogeography of *Ulnaria* and *Stauroneis*

Western Ghats is one of the biodiversity hotspots with unique biochemical and ecological processes, which resulted in high levels of endemic biodiversity. The current investigation of samples using morphology based taxonomy has resulted in discovery of number of species of diatoms new to science. The study revealed around 15 new species belonging to the genus *Stauroneis* (Figure 13). This suggests that the Western Ghats diatom flora is more species rich and express a unique distribution pattern across the Ghats. Further our studies also address the cryptic diversity of the genus *Ulnaria* (Figure 14). Current work based on morphology and molecular data reveals putative new species



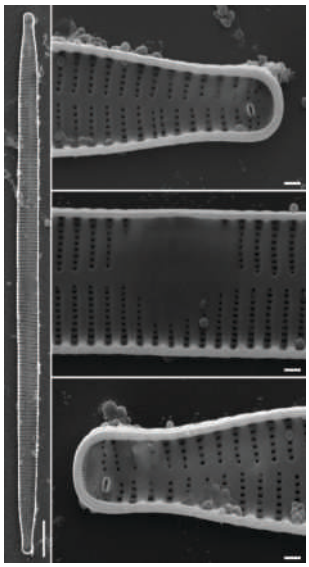


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Figure 13

Stauroneis sp. from the Western Ghats

Figure14

Ultra structural details of the *Ulnaria* sps. from the Western Ghats

closely associated with Southeast Asian members. Additionally this study marks the first molecular based species description from the Indian subcontinent.

Diatoms as a tool for tracking the climatic history of the Western Ghats

Climate change is the major issue of concern in front of us for our present as well as future. Past climate is a key to predict the future climate scenarios. Diatoms are used as biological indicators to understand the climatic history of a region, due to the preservation of siliceous cell wall in sediments. Our study reveals the monsoon dynamics and associated climate of the Northern Western Ghats during Holocene. This study confirms that early Holocene was characterized with high rainfall and subsequently got reduced in mid Holocene. The high rainfall periods were characterized with high abundance of planktonic diatoms (Figure 15).

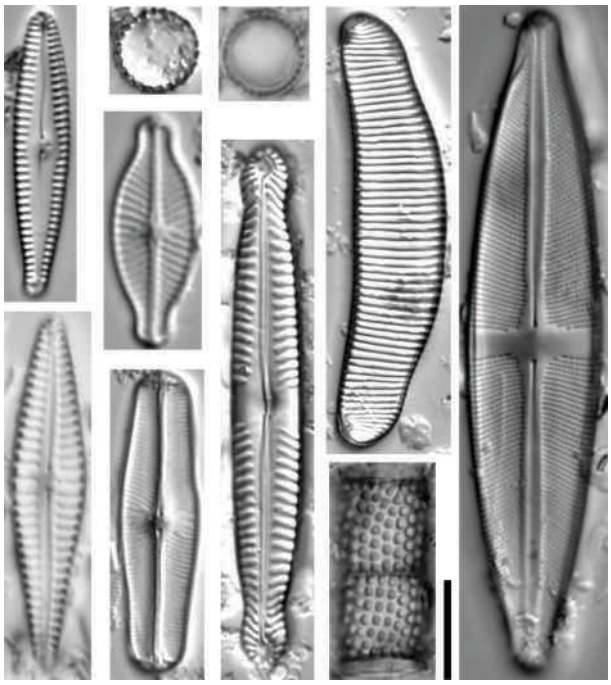


Figure 15
Plate showing dominant diatoms from the core section

Palaeobiology

Interpreting changes in palaeoenvironment using ichnoassemblages, distribution of fossil mega-invertebrates from different sedimentary basins of peninsular India as well as understanding sediment–animal relationship using modern habitats and morpho-molecular taxonomy of recent foraminifera are the foci of studies in Palaeobiology.

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

The upper Jurassic rocks of Jaisalmer Basin are categorized into Baisakhi Formation (late Oxfordian-Kimmeridgian) and Bhadasar Formation (Tithonian-Early Cretaceous?). Rupsi, Ludharwa and Lanela, the three formal units of Baisakhi Formation, are defined by changes in lithology as well as ichnoassemblages and ichnofacies. The transition from *Zoophycos* ichnofacies (lower member) through *Cruziana* to *Skolithos* (middle member) to *Cruziana* (upper member) suggests a shift in depositional environments implying a regressive phase from lower to middle member followed by a transgressive phase (Figure 16). Occurrence of *Ptilophyllum* foliages (Figure 17) in two localities viz., 4 km south of Lanela (Figure 18a) and 3 km south-east of Kathori (Figure 18b), in the middle member are suggestive of proximity of the shoreline. Occurrence of *Ptilophyllum* in the coeval rocks of the neighbouring Kachchh basin does not necessarily indicate identical environments of deposition. The Baisakhi *Ptilophyllum* occurs in a delta front deposit while that in the Kachchh Basin is associated with grey to dark black laminated gypseous shales containing coaly streaks and stringers indicative of a prodelta setup.

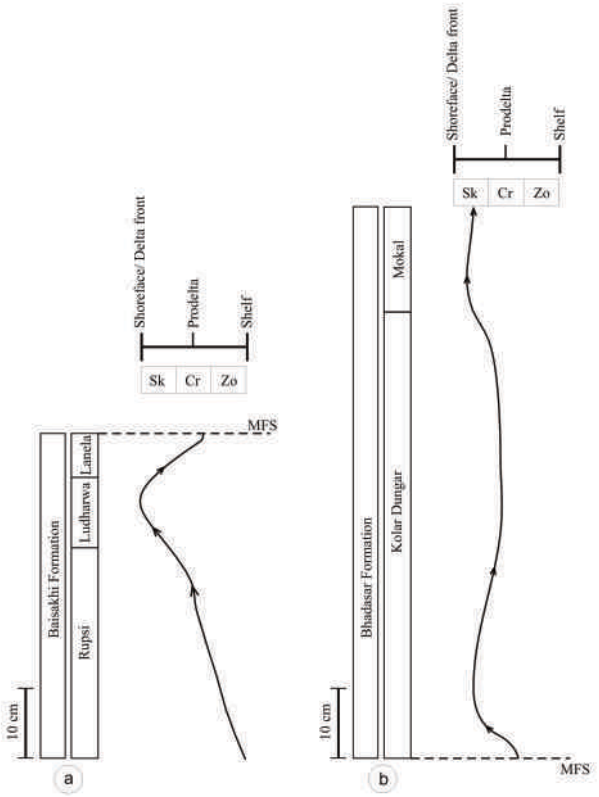


Figure 16
Sea level fluctuation curve based on ichnofacies distribution

a. Baisakhi Formation (Late Oxfordian-Kimmeridgian)

b. Bhadasar Formation (Tithonian- Early Cretaceous?)

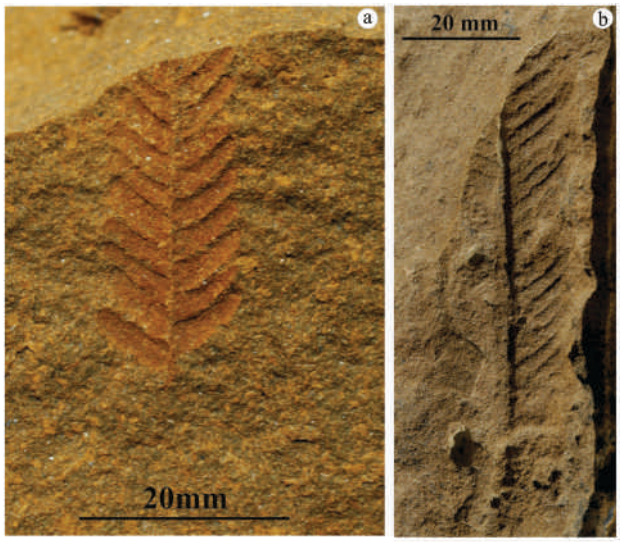


Figure 17
Ptilophyllum sp. from Middle Member of Baisakhi Formation, Rajasthan

a. *Ptilophyllum* sp., 4 km south of Lanela

b. *Ptilophyllum* sp., 3 km south-east of Kathori

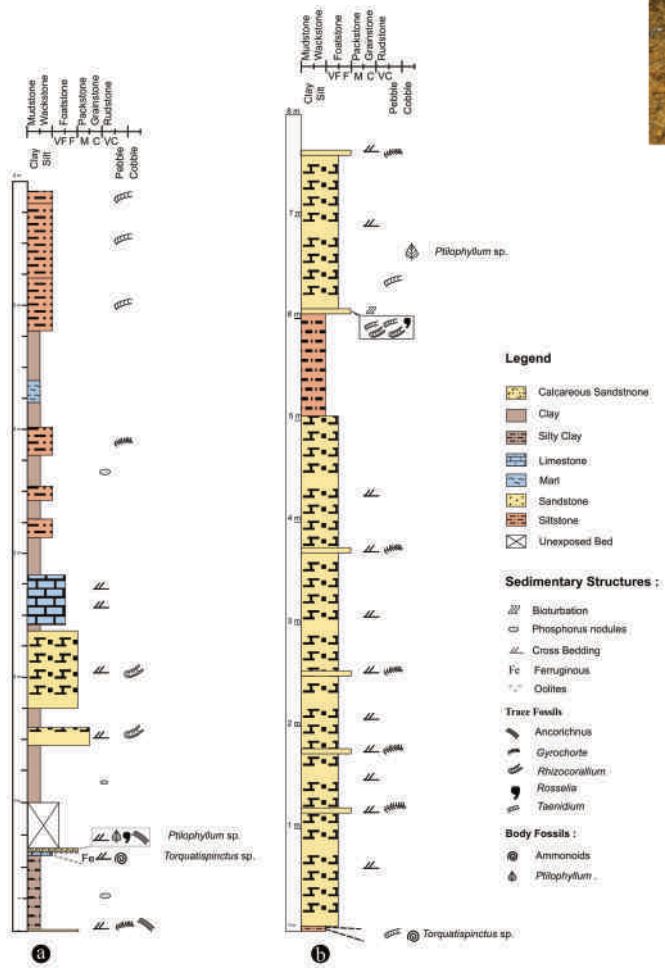


Figure 18
Lithosections of the *Ptilophyllum* yielding localities

a. Section exposed 4 km south of village Lanela

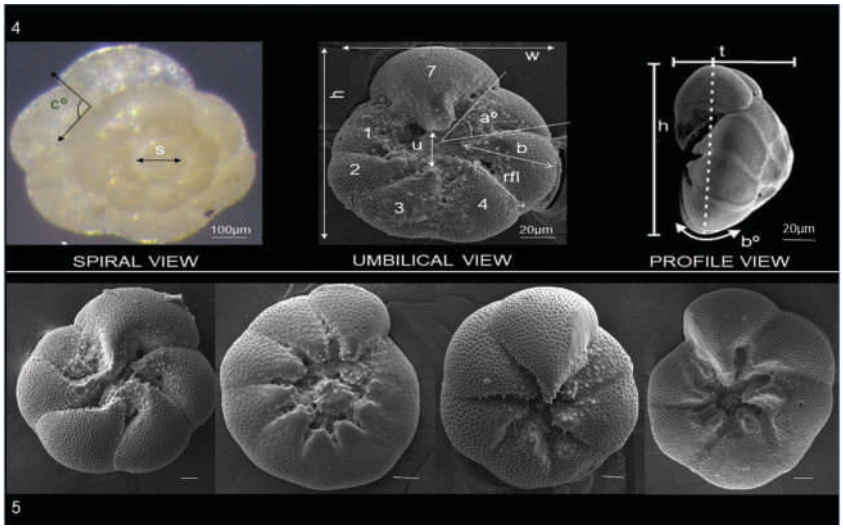
b. Section exposed 3 km southeast of Kathori

Presence of ammonoids *Hildoglochiceras* sp. and *Torquatisphinctes* sp. confirms a Middle Kimmeridgian age for the *Ptilophyllum* bearing rocks.

The Kolar Dungar Member and Mokal Member, the two formal litho-units of the Bhadasar Formation, are demarcated by a variation in lithology as well as ichnocoenose. The Kolar Dungar ichnoassemblage is fodinichnia dominated, indicative of detritus rich in organic matter underlining lower energy conditions. Whereas, the Mokal Member shows equal distribution of fodinichnia and domichnia representing both deposit feeders as well as filter-feeders conjecturing the greater abundance of nutrition as well as higher energy conditions. Lithological and other sedimentary evidences suggest a wave-dominated delta front environment for both the members. Microenvironmental fluctuations, especially regarding availability and distribution of food are best interpreted by ichnofossil analysis (Figure 18b).

Distinction of intertidal benthic foraminiferal genus *Ammonia* using molecular tools

This study was set out to add new insight into the genetic diversity and biogeographic distribution of *Ammonia* (Brunnich, 1772), an intertidal benthic foraminifera from Northeast Arabian Sea. Four morphological distinct varieties of genus *Ammonia* were observed in sample (Figure 19 - 4&5). Morphological characteristics have been measured from images taken using scanning electron microscope comprising variables considered important for identification (Figure 19 - 4). Genetic analysis based on small subunit (SSU) ribosomal DNA sequences generated during this study suggest that *Ammonia* specimens sampled belong to the four gene genetic types (Figure 19 - 5).



This is a new approach towards the taxonomic revision of the world's most commonly misidentified for -aminiferal genus *Ammonia.*

Figure 19(4)

Morphological distinction using variables considered important for identification.

Figure 19(5)

Four different gene genetic types in intertidal benthic foraminifera genus *Ammonia* have been identified using integrated morphological and molecular approach. Scale bar: 20 µm

BIOENERGY GROUP

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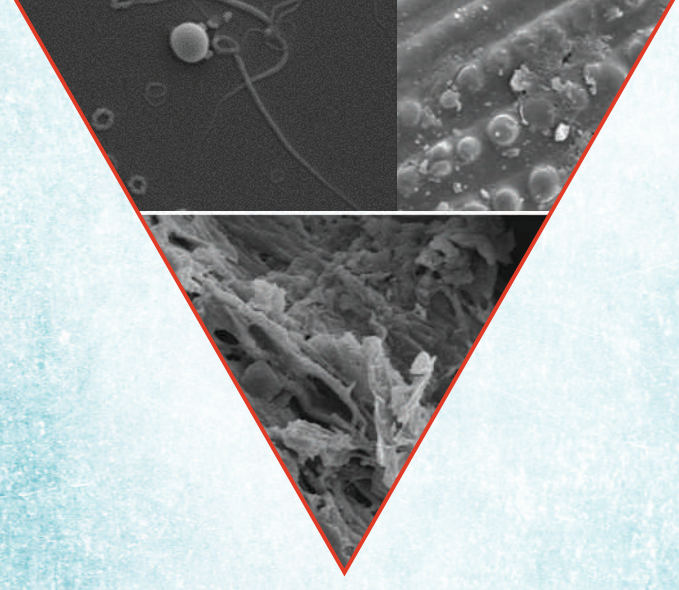

BIOENERGY

Exploring microorganisms for industrial applications especially in petroleum biotechnology and bioenergy is the major emphasis of research in Bioenergy. Microbes have been explored for enhanced oil recovery from high temperature depleted oil reservoirs, method for the inhibition of sulfate reducing bacteria, and biomethanation.

Microbial Enhanced Oil Recovery (MEOR)

A microbial process for enhanced oil recovery from high temperature (96˚C) reservoirs is developed at laboratory scale. The consortium, designated as 101C5 (Figure 20) was found to be a promising candidate for MEOR at high temperature in simulation studies i.e. sand pack experiments. However, it was observed that the reservoir properties significantly influenced the oil recovery efficiency of 101C5 consortium. Hence, the effect of different reservoir properties such as porosity, rock type, temperature, pressure, etc. on 101C5 mediated enhanced oil recovery was investigated. The range of each parameter that allowed luxuriant growth as well as production of desired metabolites leading to recovery of residual oil was determined. The 101C5 consortium was found to be suitable for recovery of residual oil from different reservoir types such as Berea, sandstone and carbonaceous rocks. 101C5 consortium was active at 70-101˚C and 700-1500 psi pressure. The intergranular/ vugular/ fractured porosity associated with different types of reservoir rocks did have effect on the MEOR. 101C5 was the most effective in fractured porous environment. The influence of such reservoir properties on the efficiency of microbial enhanced oil recovery is illustrated in Table 1.

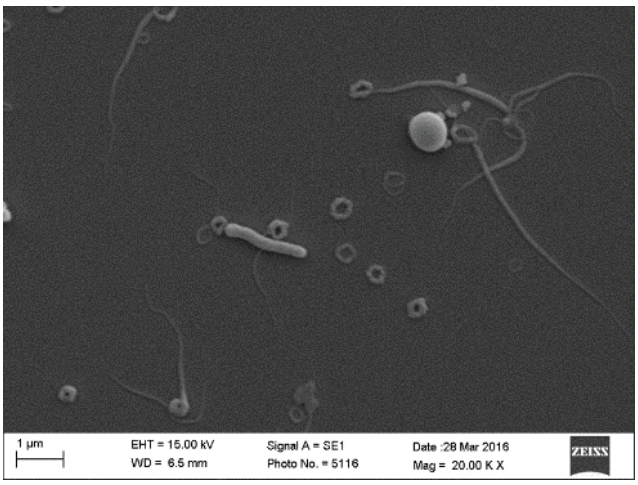

Figure 20
Scanning Electron Microscopic image of hyper-thermophilic microbial consortia 101C5

a. Section exposed 4 km south of village Lanela

b. Section exposed 3 km southeast of Kathori

Table 1 Effect of reservoir properties on the 101C5 mediated recovery of residual oil in simulated studies

Reservoir properties tested	Description of reservoir properties conducive for 101C5 mediated EOR
Porosity	**Range tested**: Intergranular / intercrystalline, vugular /solution and fracture / matrix porosity • 101C5 effected highest oil recovery (26.1%) in fracture/matrix porosity
Rock type	**Range tested**: Berea sandstone, carbonate rock, reservoir rock, chalk core • 101C5 effected highest oil recovery (47.5%) in carbonate rock
Temperature	**Range tested**: 70 – 101 ˚C • 101C5 could grow and effect oil recovery at wide range of temperature 70 - 101 ˚C, highest oil recovery (55.8%) was effected by consortium at 101 ˚C
Pressure	**Range tested**: 700 - 1500 psi • 101C5 could grow and effect oil recovery at wide range of pressure 700 - 1500 psi, highest oil recovery (7%) was effected by consortium at 1420 psi

Bacteriophage for controlling souring of oil reservoirs

Sulfate reducing bacteria (SRB) are notorious organisms in the oil reservoirs because of their property to produce hydrogen sulphide, which adversely affects the quality of crude oil and also causes corrosion of pipelines/ machinery. H_2S is also hazardous to human health. Currently, the petroleum industry spends $7 billion annually on biocides to control SRB. However, these biocides are recalcitrant to environment and are hazardous to human health, besides they are not sufficiently effective against the target bacteria.

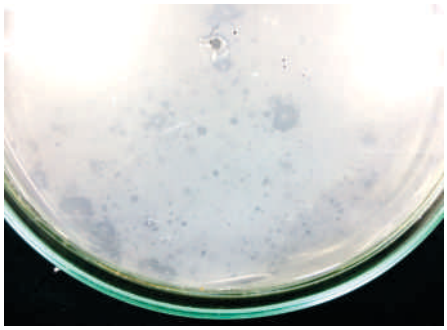

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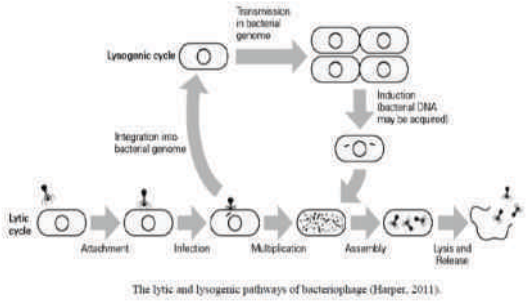
Figure 21
Plaques formed by bacteriophages lytic for *Desulfovibrio indonesiensis*



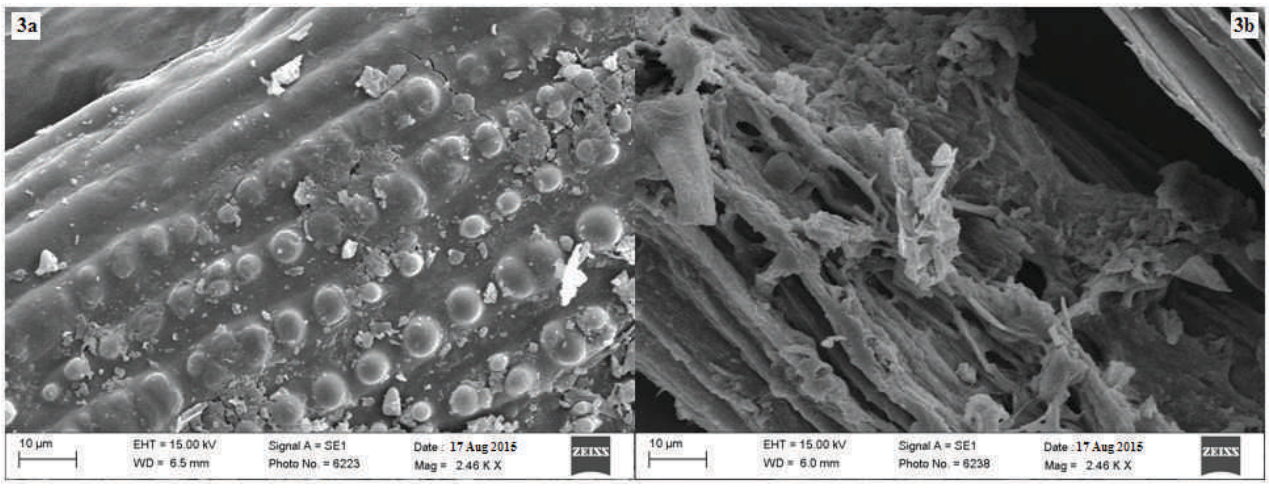
The lytic and lysogenic pathways of bacteriophage (Harper, 2011).

△
Figure 22
Lytic and lysogenic pathways

A biocontrol method for the inhibition of SRB and SRB associated souring of petroleum reservoirs is developed. This method uses SRB lytic bacteriophages that infect and lyse SRB. The purified SRB lytic bacteriophage enriched, isolated and characterized in the present study was able to inhibit the diverse species of sulfate reducing bacteria. Two log cycle reduction in the SRB count was obtained when either a consortium of SRB or enriched SRB from oil reservoir were mixed with the purified bacteriophage. The lytic bacteriophage mediated inhibition of SRB was observed within 48 hours of infection. Inhibitory effect of the bacteriophage lasted for more than 28 days. The biocontrol process for bacteriophage mediated inhibition of SRB is an effective, inexpensive and environmentally benign biocontrol process (Figure 21, 22).

Biomethanation of rice straw

Rice is one of the most important agricultural crops in India. Approximately 133 million tons of rice straw is produced every year in our country. Most of the straw is either left unused and burnt on-farm which has adverse effects on human health and the environment. A sustainable process to extract energy from such huge renewable resource in the form of biomethane, which can be subsequently used for electricity generation or converted into bioCNG to be used as vehicular fuel is developed. The process for biomethanation of rice straw comprises of two parts, (i) saccharification and further biodegradation of lignocellulosic biomass into VFA and/ or H_2CO_2; (ii) conversion of H_2CO_2 and VFA into biomethane using efficient methanogens. The uniqueness of the process is the alkali pretreatment of rice straw at ambient temperature, which reduces enormous operational expenditure on heat treatment (Figure 23). Another USP of the process is biomethanation at elevated temperature (55 °C). Various process parameters were optimized for the pre-treatment as well as biomethanation of rice straw to maximize the methane generation. Under optimized conditions of pretreatment (1 % NaOH, at ambient temperature, for 180 min) and optimum process parameters (pH 7, temperature 37°C, particle size 1 mm , S/I ratio of 1 and



Pretreated rice straw

Untreated rice straw

Figure 23
Structural change analysis of rice straw using SEM

HRT of 15 days) enhanced methane yield of 300 L/Kg VS of rice straw was obtained which was approximately 55 % more than that of control. Thermophilic biomethanation process has several advantages such as high rate of volatile solids reduction, higher methane yield, low hydraulic retention time (HRT) and production of class A bio-solids which are pathogen free. For thermophilic process the startup inoculum (cattle dung) was supplemented with three different strains of thermophilic methanogen, *Methanothermobacter thermoautotrophicus*. After optimization methane yield of 279 L/kg VS rice straw was obtained in only 7 days which was half the HRT reported earlier. Anaerobic digestion of rice straw at 7.5 % (w/v) loading rate at 55°C in continuous mode with 10 days HRT resulted in methane yield of 300 L/kg VS. The obtained methane yield at 10 days HRT is one of the highest for the biomethanation of rice straw in continuous mode. Interestingly, this process resulted in enhanced methane (up to 75 %) and low CO_2 content, low accumulation of volatile fatty acids, and faster degradation of different lignocellulosic components.

BIOPROSPECTING GROUP

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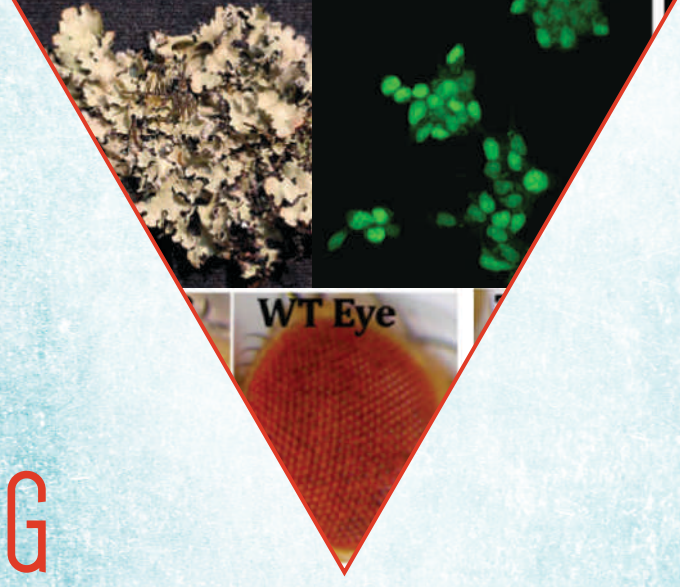
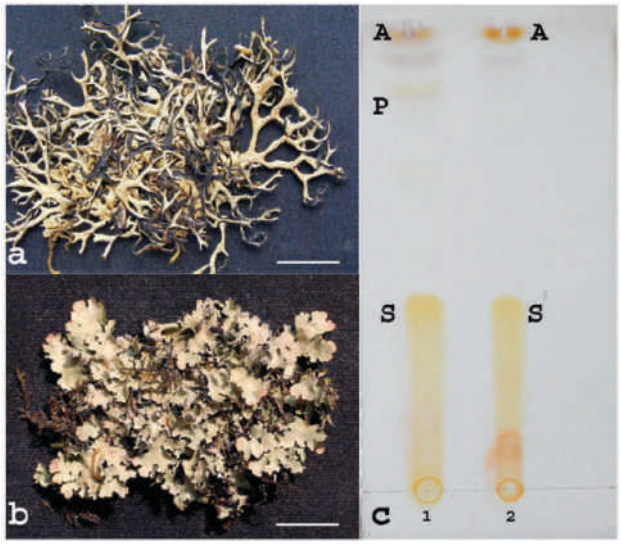


BIOPROSPECTING

The isolation and synthesis of naturally occurring compounds, derivatives and their use in pharmaceuticals, nutraceuticals, agriculture and industries, is the focus of research under bioprospecting.

Lichens

Cardioprotective and anticancer potential of lichenized fungi from Western Ghats



Fresh lichen thallus of *E. cirrhatum* and *P. reticulatum* (Figure 24 a, b), locally known as 'Jhavilla', were collected from Munnar, Idukki district, Kerala, at an altitude of ~1,700 m in the Western Ghats. They have been traditionally used to treat kidney, blood, heart, piles, and stomach-related disorders in India.

Figure 24
a. Natural thallus of *Everniastrum cirrhatum*
b. Natural thallus of *Parmotrema reticulatum*
c. TLC plate of lichen *E. cirrhatum* (1) and *P. reticulatum* (2). Scale bar (a and b:2 cm).
Abbreviations: A atranorin; P protolichesterinic acid; S salazinic acid

Colorectal cancer and cardiac diseases share diet-related risk factors of obesity and consumption of saturated fat, and individuals with CVD are at a greater risk for cancer. The role of OS in the etiology of cancer, as in cardiac maladies, is well known. Another link between cancer and cardiac diseases is HMG CoA reductase, which is a prime target for anticancer therapy. For these reasons, inhibition of angiotensin converting enzyme, HMG-CoA reductase, and thrombosis have a therapeutic significance in the prevention of CVD, and owing to their association with cancer, dietary interventions may aid in cancer care and management.

Angiotensin converting enzyme (ACE) inhibition

The ethyl acetate extract of *P. reticulatum* and *E. cirrhatum* at 150 µg.mL^{-1} showed ACE inhibitions of 65.35 % and 53.59 %, respectively. ACE inhibition by methanol extract of both the species was in the range of 36.60–47.05 %. The acetone extract exhibited the lowest inhibition for both the species. The standard ACE inhibitor, captopril, showed 78.43 % of ACE inhibition at 50 µg.mL^{-1}.

HMG-CoA reductase inhibition

In *P. reticulatum* and *E. cirrhatum*, methanol extract was a more effective HMG-CoA reductase inhibitor, with 40.60–67.81% inhibition, than ethyl acetate extract, which showed inhibition in the range of 37.36–51.94%. Pravastatin, a standard HMG-CoA reductase inhibitor, showed 96.86% enzyme inhibition, which was higher than that of the tested lichen extracts.

Fibrinolytic activity

The ethyl acetate fraction of *E. cirrhatum* at 5 mg.mL^{-1} had fibrinolytic potential with a 7 mm inhibition zone compared to the 8 mm zone shown by standard Plasmin at 1 mg.mL^{-1}.

Anticancer potential

Cytotoxicity of lichen extracts at 50–250 µg.mL^{-1} against HCT-116 cell line was evaluated using MTT assay upon 24, 48, and 72 h of treatment. All the extracts showed promising inhibition of cell growth at 250 µg.mL^{-1} over 72 h of incubation (Figure 25). *P. reticulatum* showed the least percent viability in both methanol and ethyl acetate extract, at 39.50%and 44.83%, respectively. Similarly, ethyl acetate extract of *E. cirrhatum* showed greater than 50% reduction in cell viability (46.81%) at 250 µg.mL^{-1}. Maximum reduction in percent cell viability at the least concentration tested (50 µg.mL^{-1}) was shown by the methanol extract of *P. reticulatum* (71.70%) and *E. cirrhatum* (79.83%) upon 72 h of incubation. In comparison, Triton X-100 reduced the percent cell viability to up to 3.35%, whereas the usnic acid (5–25 µg.mL^{-1}) showed it in the range of 69.28–99.31%.

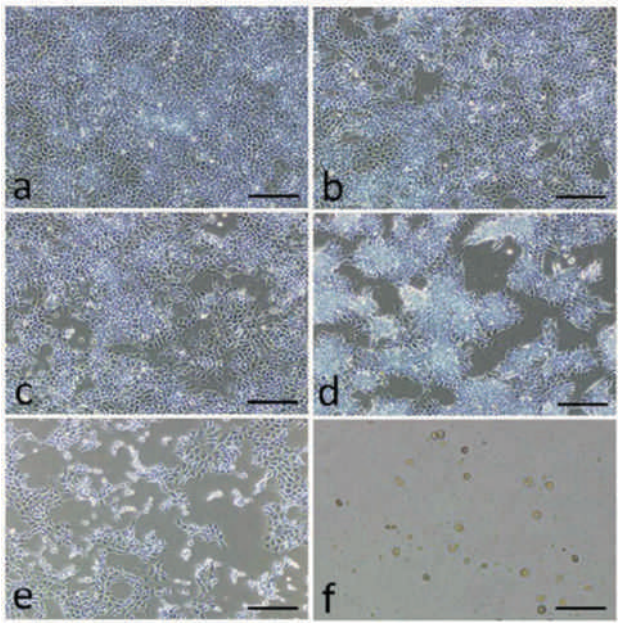


Figure 25
HCT-116 cell growth inhibition upon 72-h treatment with various lichen extracts at 250 µg.mL–1 concentration: (a) growth control; (b) *Everniastrum cirrhatum*–MeOH; (c) *E. cirrhatum*–EtAc; (d) *Parmotrema reticulatum*–EtAc; (e) *P. reticulatum*–MeOH; (f) Triton X-100 (1%). Scale bar (a–e, 100 µm; f, 50 µm). Abbreviations: MeOH, methanol extract; EtAc, ethyl acetate extract

The results of this study suggest further research on these two species to purify their phytocompounds and evaluate for the biological activities for better understanding of their therapeutic efficacy.

Fluorescent probes to evaluate copper associated intracellular stress

Copper is present throughout the brain and its dyshomeostasis is implicated directly or indirectly in the etiology of neurodegenerative diseases, including Alzheimer's dis-ease (AD), amyotrophic lateral sclerosis, Parkinson's disease, and prion disease. Aβ peptide is a 40−42 amino acid chain and comprises a metal binding region (1−16) and an aggregation-prone region (17−40/42). Amyloid β (Aβ) peptide involved in AD is known to bind copper to form Aβ-Cu (II) and Aβ-Cu (I) complexes. The conversion of Aβ-Cu (I) to Aβ- Cu (II) initiates Fenton's reaction to produce reactive oxygen species (ROS) and generates oxidative stress in the neuronal cell. In addition to this, ROS reacts with Aβ to produce toxic oxidation products such as dimeric and trimeric peptide species. Copper is also known to enhance peptide aggregation kinetics, leading to amyloid plaque formation in the brain, which is one of the hallmarks of AD. Thus, copper plays a crucial role in the neurodegeneration and progression of AD.

A variety of fluorescent probes are proposed to monitor the intracellular copper content. So far, none of the probes have been evaluated for their potential to inhibit copper-associated intracellular oxidative stress. Herein, we studied the ability of a fluorescent copper probe, OBEP-CS1, to inhibit intracellular oxidative stress associated with an amyloid β (Aβ) peptide-copper complex. The data showed that OBEP-CS1 completely inhibits the copper-catalyzed oxidation as well as decarboxylation/deamination of Aβ1−16. Moreover, the cell imaging experiments (Figure 26) confirmed that OBEP-CS1 can inhibit Aβ- Cu (II)-catalyzed reactive oxygen species production in SH-SY5Y cells. We also demonstrated that Aβ1−16 peptide can bind intracellular copper and thereby exert oxidative stress.

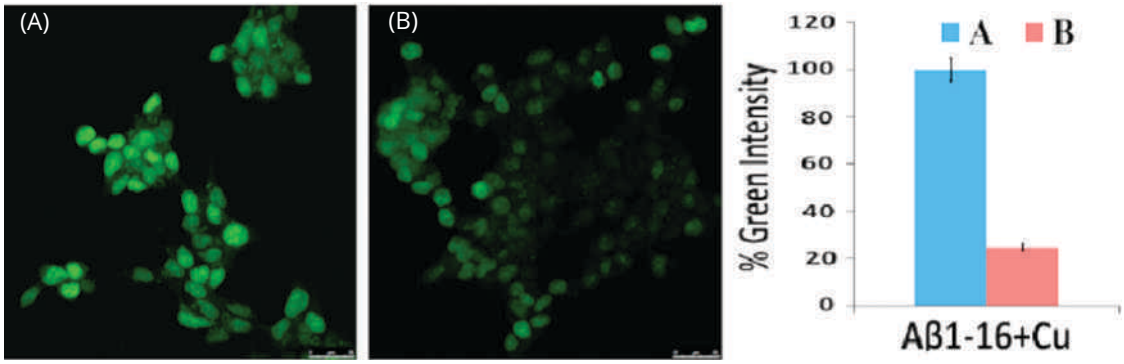


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Figure 26

Live confocal imaging of SH-SY5Y cells stained with 5 μM CellROX green upon 10 min of treatment (λex/em = 485/500−550 nm): (A) cells treated with 50 μM Aβ1−16-CuII (1:1) for 18 h; (B) cells treated with 50 μM Aβ1−16-CuII for 18 h, washed with phosphate buffered saline, and treated with 5 μM OBEP-CS1 for 15 min; (C) normalized mean intensity of emission from quantitative analysis (by ImageJ software) of the green region in images A and B

Thiosemicarbazone assisted inhibition of amyloid beta peptide

Alzheimer's disease (AD) is a multifactorial neurodegenerative disorder. Aggregation of Aβ peptide, Ab-induced cytotoxicity and deficit of the neurotransmitter acetylcholine are strongly linked to the progression of AD. Herein, we synthesized aromatic thiosemicarbazone (TSC) analogues with two, three and four phenyl rings. Result obtained from docking studies showed that hydrophobic aromatic moieties are essential for interaction with aggregation prone region of Aβ peptide while thiosemicarbazone forms hydrogen bonding contacts with peptide residues. Docking studies also demonstrated that phenyl rings and thiosemicarbazone moiety present in TSC 3 forms hydrophobic interactions as well as hydrogen bonding interactions with CAS region of AChE respectively (Figure 27). Results of turbidity assay and ThT assay revealed that TSC 3 with four phenyl rings exhibited improved inhibition of Aβ (1-42) peptide aggregation. Interestingly, TSC-3 also showed reversal of rough eye phenotype even at 20 mM concentration in the *Drosophila* model of AD (Figure 28).

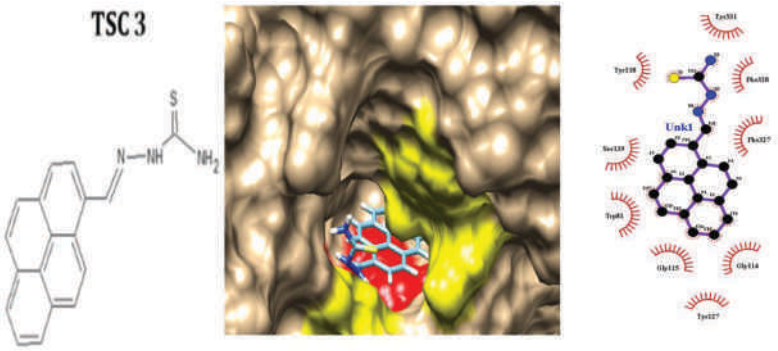
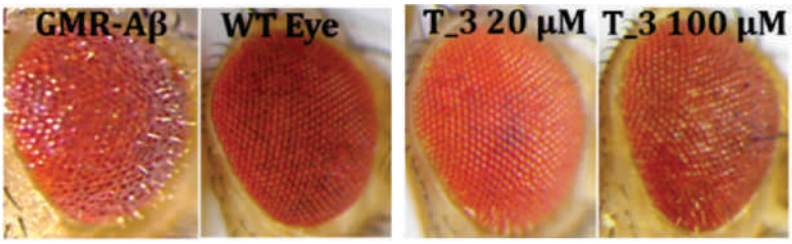


Figure 27
Structure of TSC-3 and its docking with acetylcholine esterase

Figure 28
Effect of TSC 3 in rescuing rough eye phenotype of GMR *Drosophila* flies using Light microscopy



Antitubercular activity of rugosaflavonoid derivatives

Mycobacterium tuberculosis (Mtb) is the causative agent of tuberculosis (TB), which affected approximately 10.4 million people in 2015. The World Health Organization (WHO) introduced the DOTS (Directly Observed Treatment, Short Course) strategy, which has proven successful in effectively achieving treatment rates of higher than 90 %. However, the prolonged duration (6–9 months) of the DOTS strategy and spontaneous gene mutations in pathogenic strains have led to resistance to the drugs. Hence, the emergence of cases of multi-drug resistance (MDR) and extensive drug resistance (XDR) have increased in recent years. To overcome the problems associated with this pandemic, there is an urgent need to develop effective strategies for treating and controlling TB. One strategy would comprise targeting essential enzymes of Mtb that are relevant to its survival and growth within the host

cell. In this context, enzymes that participate in biosynthetic pathways represent attractive targets for the discovery of novel anti-tuberculosis agents. Among these, β-ketoacyl-ACP synthase (KAS) and pantothenate kinase (PanK) are two target enzymes that play important roles in the fatty acid synthesis (FASII) system and the biosynthetic pathway of coenzyme A (CoA), respectively. 3,4 β-Ketoacyl-ACP reductase (MabA) comprises a complex group of enzymes responsible for the production of very-long-chain fatty acid derivatives that are the chief precursors of mycolic acids. Pantothenate kinase (PanK), on the other hand, catalyzes the ATP-dependent phosphorylation of pantothenate, which is the initial step in the universal biosynthetic pathway of coenzyme A (CoA) from pantothenic acid. Rugosaflavonoid and its derivatives showed in Table 2 are prepared in our group and their docking studies are performed with both the enzymes (MabA, PDB Code: 1UZN and PanK, PDB Code: 3AF3). Compounds 5a, 5c, 5d, and 6c, which had docking scores of -8.29, -8.36, -8.17 and -7.39 kcal mol^{-1}, respectively, displayed interactions with MabA and showed better docking score of isoniazid (-6.81 kcal mol^{-1}) (Figure 29).

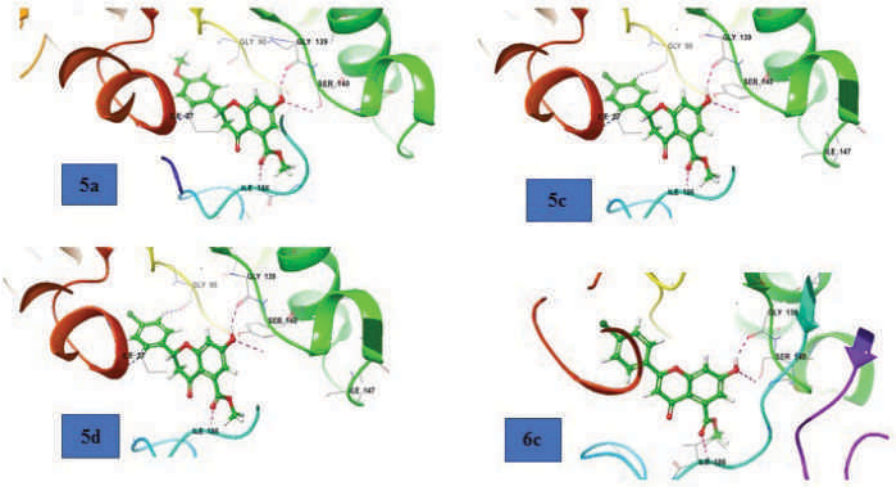


Figure 29
Docking Image Rugosaflavonoid and its derivatives with 1UZN

Similarly, compounds 5a, 5c, 5d, and 6c, which had docking scores of -7.55, -7.64, -7.40 and -6.7 kcal mol^{-1}, respectively, displayed interactions with PanK that were comparable to those of isoniazid (-7.64 kcal mol^{-1}) (Figure 30).

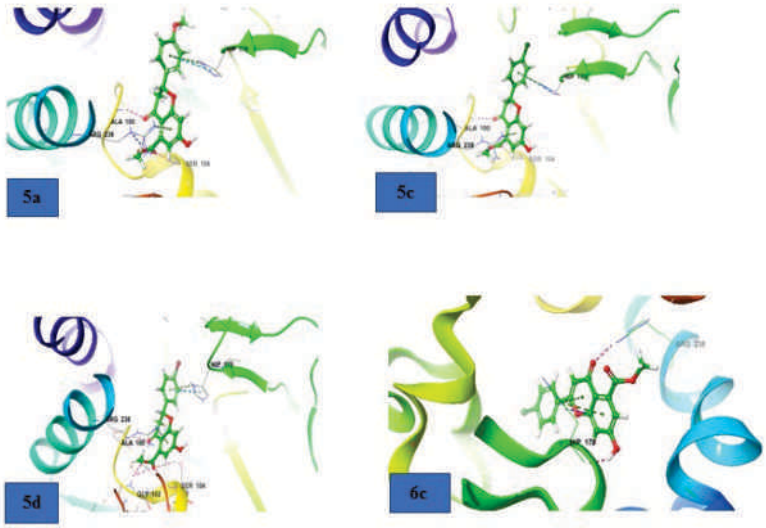
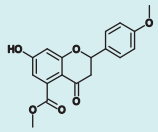
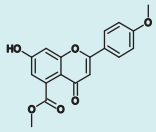
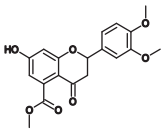
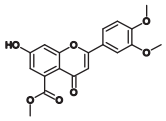
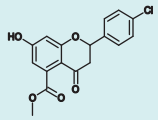
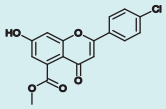
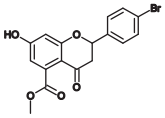
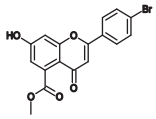
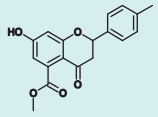
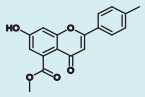
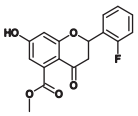
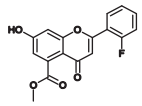


Figure 30
Docking image Rugosaflavonoid and its derivatives with 3AF3

Because of their docking scores, these compounds were screened in vitro against *M. tuberculosis* H37Ra (Mtb) using an XRMA protocol. The isoniazid and quercetin were used as reference standard.

Table 2 *In vitro* antitubercular activity results of 5a-f and 6a-f aginst Mtb-H37Ra

Sr. No.	Structure	IC_{50} µg/ml	MIC_{90} µg/ml	Sr. No.	Structure	IC_{50} µg/ml	IC_{90} µg/ml
5a		12.93	>30	6a		>30	>30
5b		>30	>30	6b		>30	>30
5c		8.43	27.26	6c		17.57	28.90
5d		11.3	>30	6d		>30	>30
5e		25.21	>30	6e		>30	>30
5f		>30	>30	6f		>30	>30
	Isoniazid	0.074	0.002				
	Quercetin	12.61	>30				

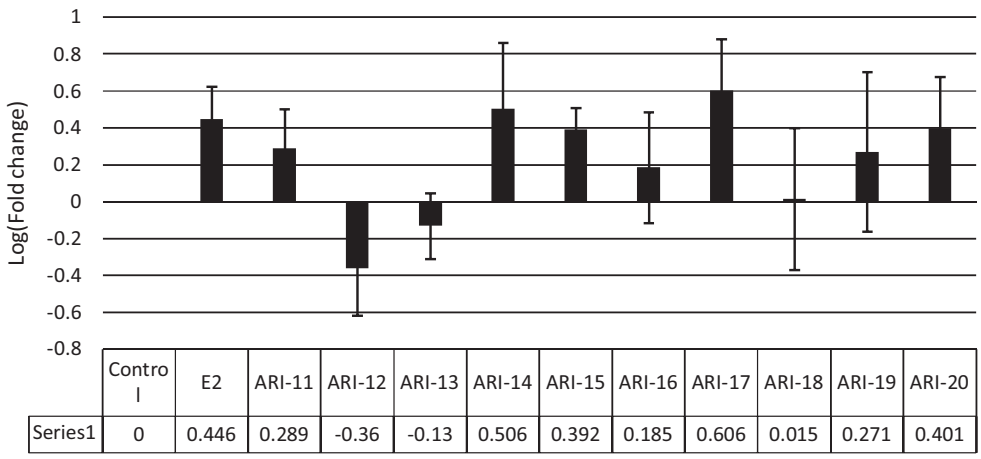
Among the screened compounds, the dihydrorugosaflavonoid derivatives 5a, 5c, and 5d had IC_{50} values of 12.93, 8.43 and 11.3 µg mL^{-1}, respectively, and exhibited better inhibitory activity than the parent rugosaflavonoid derivatives. The rugosaflavonoid derivative 6c had an IC_{50} value of 17.57 µg mL^{-1}. The synthesized compounds also displayed inhibitory activity against the Gram-positive bacteria *Bacillus subtilis* and *Staphylococcus aureus*.

Estrogenic and antiestrogenic activity of naturally occurring molecules

Estrogens interact with the receptor in a selective way, which helped to develop therapeutics for breast cancer. Ample amount of literature is available to prove the exogenous and endogenous behavior of estrogens in the pathogenesis of breast cancer. Previously, Tamoxifen was the only medicine of choice to treat patients with estrogen related (ER) positive breast tumors. With advanced research flavones have

shown tremendous potential to curb cancerous growth. Therefore, molecular docking of naturally occurring flavones and rugosaflavonoid derivatives were carried out with estrogen receptors 3ERT and 1GWR was performed using Maestro software 11.2 from Schrodinger (Figure 31). Analysis by docking score and receptor ligand interactions supported that flavones may behave as selective estrogen receptor modulators (SERMs). Baicalin and naringin and 4-chlororugosaflavonoid, 4-bromrugosaflavonoid derivatives showed docking score of -11.147 and -9.397, -9.321, and -8.976 with 3ERT respectively, which were found close to the docking score of tamoxifen and raloxifene with 3ERT. Therefore, the experiments were performed using luciferase assay to identify the estrogenic and antiestrogenic properties (Figure 32). Baicalein has showed estrogenic property and naringin, 4-chlororugosaflavonoid, and 4-bromrugosaflavonoid showed antiestrogenic properties.

Figure 31
Binding of flavones with estrogen receptors



	Control	E2	ARI-11	ARI-12	ARI-13	ARI-14	ARI-15	ARI-16	ARI-17	ARI-18	ARI-19	ARI-20
Series1	0	0.446	0.289	-0.36	-0.13	0.506	0.392	0.185	0.606	0.015	0.271	0.401

Figure 32
Luciferase assay of naturally occurring flavones

DEVELOPMENTAL BIOLOGY GROUP

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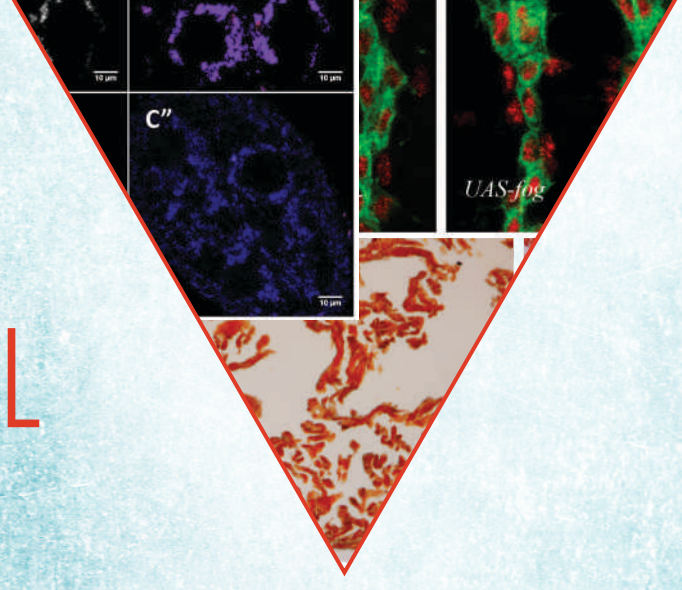

DEVELOPMENTAL BIOLOGY

Model organisms such as hydra, drosophila, and zebrafish to study different processes during development and regeneration such as autophagy, cell-cell communication, regulation of cell morphogenesis etc.

Hydra

Hydra as a model system for teaching and research

We have been using Hydra, a fresh water Cnidarian, as a model system to study regeneration and pattern formation. Our work indicates that hydra possesses several signaling pathways important in vertebrate tissue patterning making hydra an important model in evolutionary developmental biology (Evo-Devo). In an attempt to introduce this Evo-Devo model for school, undergraduate and post-graduate teaching in India, we have begun

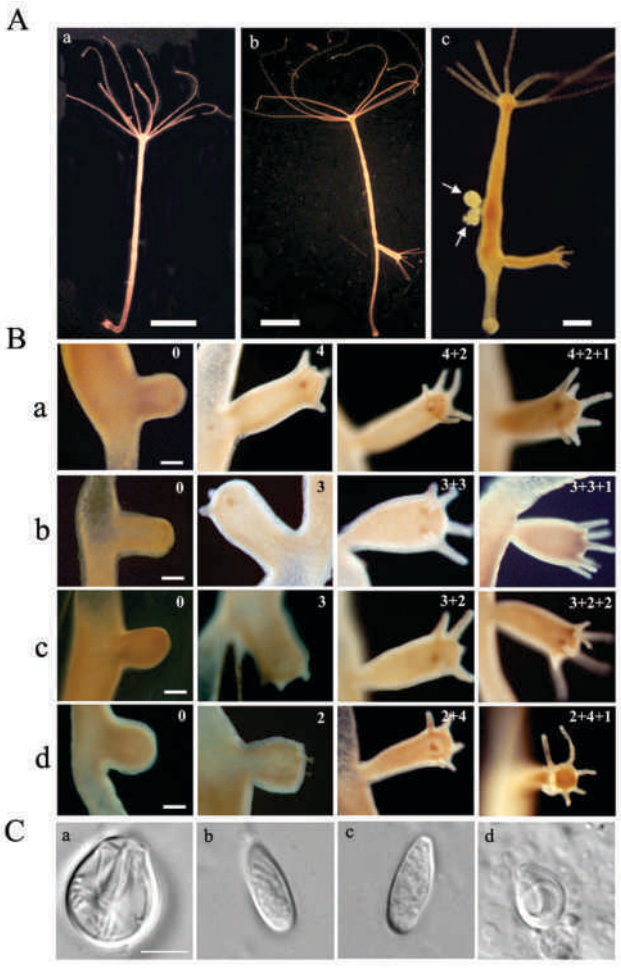

Figure 33

General morphology of *H. vulgaris* Naukuchiatal (A): Live polyps (a–c). (a) A polyp without bud (b) A polyp with bud and (c) represents polyp with two female gonads (shown by arrow). Scale bar: 1 mm. Asynchronous emergence of tentacles on developing bud of *H. vulgaris* Naukuchiatal. (B): (a) represents 4 + 2 + 1 pattern (b) represents 3 + 3 + 1 pattern (c) represents 3 + 2 + 2 pattern (d) represents 2 + 4 + 1 pattern. Scale bar: 1 mm. Types of nematocysts in *H. vulgaris* Naukuchiatal (C): (a) Stenotele (b) Holotrichous isorhiza (c) Atrichous isorhiza (d) Desmoneme. Scale bar: 5 µm.

studying hydra from different localities in the country. A hydra collected from Naukuchiatal, Uttarakhand (30º15'N and 79º15'E) was identified as *Hydra vulgaris* Naukuchiatal and was compared with *Hydra magnipapillata*, *Hydra vulgaris* AEP and *Hydra vulgaris* Ind-Pune strains. The various strains showed some similarities in overall morphology (Figure 33). However, arrangement of nema in holotrichous isorhiza nematocytes and sequences of conserved mitochondrial genes showed that Naukuchiatal hydra belongs to the '*vulgaris*' group. The variations in morphology, especially the robust and healthy appearance of Naukuchiatal hydra could be due to the pristine environment in which it exists. A report by Government of Uttarakhand, based on standard values made available by the Pennsylvania Lake Management Society, indeed shows that the quality of water in Naukuchiatal lake (nine-cornered lake) is very good since it is much less polluted. As an extension of this work, a comparative study of hydra strains from water bodies suffering from various levels of pollution is envisaged.

Drosophila

Role of autophagy in germline stem cell maintenance and ageing

Long lived proteins, toxic protein aggregates and damaged organelles are degraded by an evolutionarily conserved process called autophagy. Autophagy performs crucial functions during development and in response to stress in both unicellular and multicellular organisms. We use *Drosophila* as a model system to understand transcriptional regulation of autophagy during stress and, its role in maintenance and aging of stem cells including germline stem cells (GSCs). Several autophagy genes exhibit reduced

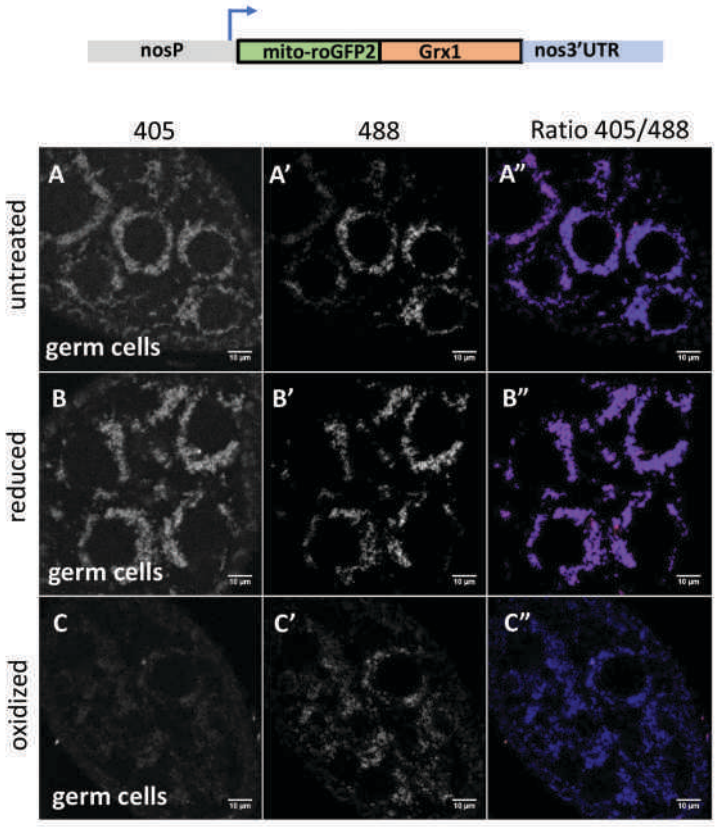

Figure 34
Analyses of mito-roGFP2-Grx1 expression in germline cells under oxidized and reduced conditions. (A-A") Expression of mito-roGFP2-Grx1 in untreated conditions, fluorescence recorded (A) at 405nm (A') at 488nm (A") merge. (B-B") Expression of mito-roGFP2-Grx1 in reduced conditions, fluorescence recorded at (B) at 405nm (B') at 488nm (B") merge. (C-C") Expression of mito-roGFP2-Grx1 in untreated conditions, fluorescence recorded (C) at 405nm (C') at 488nm (C") merge) Desmoneme. Scale bar: 5 µm.

expression in aged female GSCs as compared to young GSCs. Analyses of data from GSC maintenance assay show that GSCs loss from the niche in Atg mutants is significantly higher as compared to the controls. Moderately increasing autophagy levels in the female GSCs can sustain them within the GSC niche for longer duration. These GSCs show increased capacity of proliferation as compared to controls. The elevated levels of autophagy influence signals that maintain GSCs as well as detoxify reactive oxygen species (ROS). We have developed several germ cells specific autophagy reporters and ROS sensors (Figure 34) and are currently characterizing them in the context of aging and autophagy in the GSCs. Finally, our data will uncover a network between autophagy, growth signaling and mitochondrial ROS that regulate GSC maintenance and aging.

Cellular signalling and regulation of glial morphogenesis

Glia play an important role in the development and function of the nervous system. One of the key functions of these cells is to protect and insulate neurons, axons and synapses. This requires glia to be positioned appropriately and assume specific morphologies. We are studying how glial organization and morphology are regulated in the embryonic CNS. We focus on the longitudinal glia (LG), which sit atop the neuropil and ensheath it. In this context, we have been studying the role of Fog dependent GPCR signaling and its regulation in the CNS (Figure 35). Loss of Fog affects axonal ensheathment and overexpression of Fog leads to disorganization of glia resulting in lethality. We have found that the receptor tyrosine kinase (RTK) pathway mediated by Heartless/ FGFR functions as a negative regulator of the pathway via a mechanism that is likely to involve change in receptor stoichiometry. We are also generating reporter lines to identify enhancers that drive expression in specific glial subsets. We are currently analyzing the expression of some of these reporters.

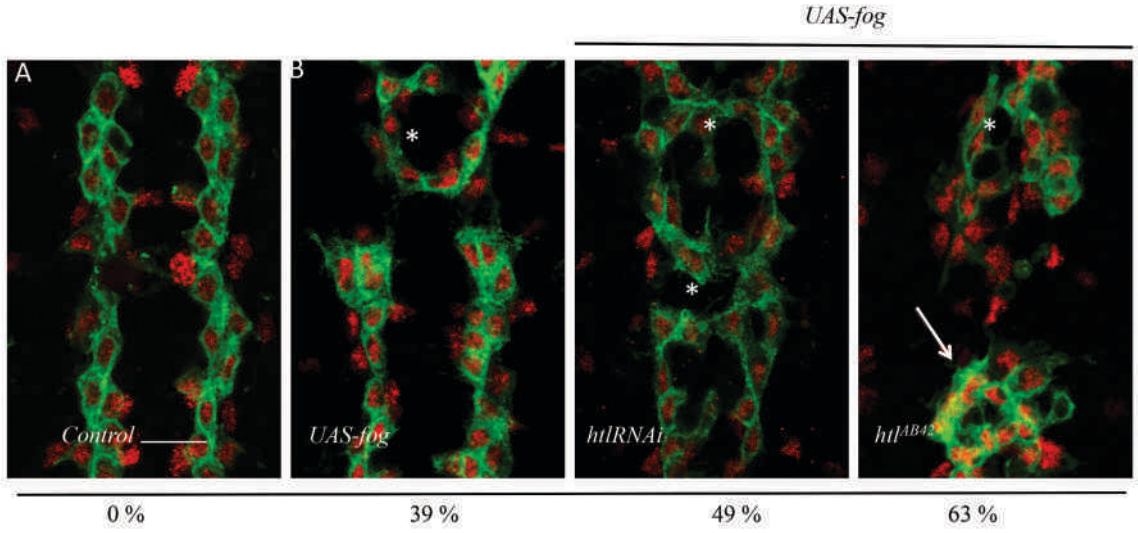

Figure 35

Heartless negatively regulates Fog signaling. (A) Longitudinal glia organized in a control embryo. GFP expression (green) marks the glial membrane. Repo (red) marks the glial nuclei. (B) Overexpression of fog causes glia to cross the midline (asterisk). (C & D) Midline crossing by glial is enhanced upon downregulation of htl using RNAi (C) or in a htl mutant (D). Note the increase in midline crossing

Zebrafish

Zebrafish as a model to study regeneration of cardiac tissue

Myocardial diseases are the leading cause of death in industrialized nations. Adult mammalian heart fails to regenerate after myocardial damage due to insufficient cardiomyocyte proliferation resulting in persistent scar and reduced heart function. In contrast, zebrafish have an astonishing capacity to replace the scar with functional myocardium having native architecture after different modes of myocardial damage. Several studies suggest that secretory molecules play an important role during organ development and regeneration via regulating growth factors or cell membrane receptors as well as interacting with extracellular matrix components. Hence in the present study, zebrafish was chosen as a model organism to identify novel secretory molecule having cardiac pro-regenerative activity.

Based on small-scale quantitative mRNA expression data of ECM coding genes, we have identified that extracellular matrix gene 1(*ecm1*) is induced in the regenerating zebrafish heart (Figure 36). Based on *in situ* hybridization and immunohistochemistry study we found that *ecm* is induced around the coronaries in the fibrotic scar tissue and in the cardiomyocytes at the border zone of the injured ventricles. Heart regeneration gets disrupted in *ecm1* indel mutants due to reduced cardiomyocyte proliferation index and migration. In addition, persistent scar is observed in the *ecm1* mutants in comparison to the wild type siblings. Transgenic *ecm1* overexpression accelerated cardiomyocyte proliferation and fibrotic scar elimination. Our study supports that Ecm1 is necessary for heart regeneration and capable to promote heart regeneration via cardiomyocyte proliferation and elimination of fibrotic scar.

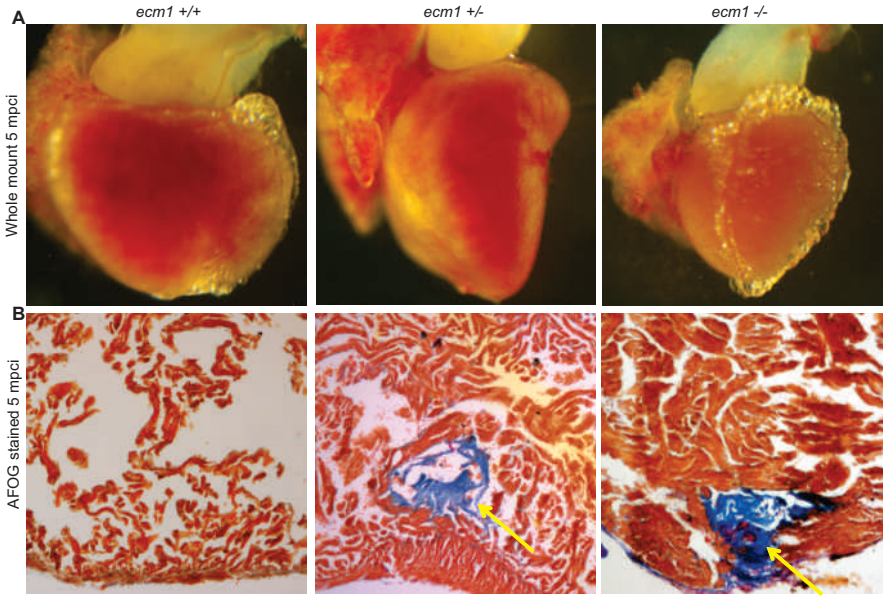

Figure 36
Ecm1 is necessary for heart regeneration in zebrafish (A) Representative brightfield images of freshly isolated hearts from 5 months post cryoinjured adult zebrafish. (B) AFOG stained transverse sections of hearts isolated from 5 months post cryoinjured wild type, heterozygous and ecm1 mutant zebrafish. Yellow arrows indicate scar tissue.

GENETICS AND PLANT BREEDING GROUP

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GENETICS AND PLANT BREEDING

ARI is engaged in improving productivity and profitability of crops on an ecological and economically sustainable basis. The institute is one of the leading centres for improvement of crops such as wheat, soybean and grapes under the All India Co-ordinated Research Projects funded by Indian Council of Agricultural Research, New Delhi.

Biotechnology

Advances in genomics and transcriptomics have provided wealth of information about crop biology. Development of functional markers using this information is ongoing which may help in breeding next generation crop varieties.

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 peninsular region and grain protein and yellow pigment content in the durum wheat varieties MACS 3125 and HI 8498. Based on replicated trial data, promising lines for all the targeted traits have been identified which can serve as genetic stocks for the improvement of other popular varieties. Three promising lines each for high grain protein content and yellow pigment content in the background of durum variety HI 8498 were included in Initial Plant Pathological Screening Nursery (IPPSN) during *rabi* season of 2016-17 for disease resistance screening. Three lines showed resistance to all the leaf rust, stem rust and stripe rust in IPPSN. One of the lines has superior alleles for high grain protein content as well as yellow pigment content.

The replacement of short arm of 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 diseases and adaptation. Many popular Indian varieties also contain this translocation. The translocation is however, associated with inherent quality problems associated with reduced dough strength and dough stickiness. However, sticky dough problem of 1BL/1RS (*Glu-B3*$^{-}$/*Sec-1*$^{+}$) can be overcome by either removal of monomeric secalins and/or addition of polymeric glutenins by introgression of new 1BL/1RS (*Glu-B3*$^{+}$/*Sec-1*$^{-}$) translocation. Introgression of this translocation in the background of popular bread wheat varieties MACS 2496, MACS 6222 and MACS 6478 using marker assisted backcross breeding approach is underway. The backcrosses are presently at BC_1F_1/BC_2F_1 stages.

TILLING resource in Indian durum wheat for forward- and reverse-genetic analysis

There is a need to develop novel dwarfing genes whose effects are limited to culm elongation and therefore retaining good seedling vigour and leaf elongation, allowing successful establishment of the crop in limited moisture conditions. EMS-mutagenized TILLING (Targeting Induced Local Legions in Genome) population of durum wheat cultivar Bijaga Yellow is generated and being screened by forward and reverse genetic approach to identify improved phenotype for various agronomically important traits as well as to identify novel mutant alleles in a gibberellin biosynthesis genes. In M_2 generation, observations were recorded regularly for 19 morphological traits at different key growth stages (Figure 37). Initial sequencing results indicated very good density of mutations (1 mutation/21kb) in M_2 population. Two mutants BYM2_189 and BYM2_2522 carrying one nucleotide change each in exon-2 of *GA20ox-A1* gene were identified.

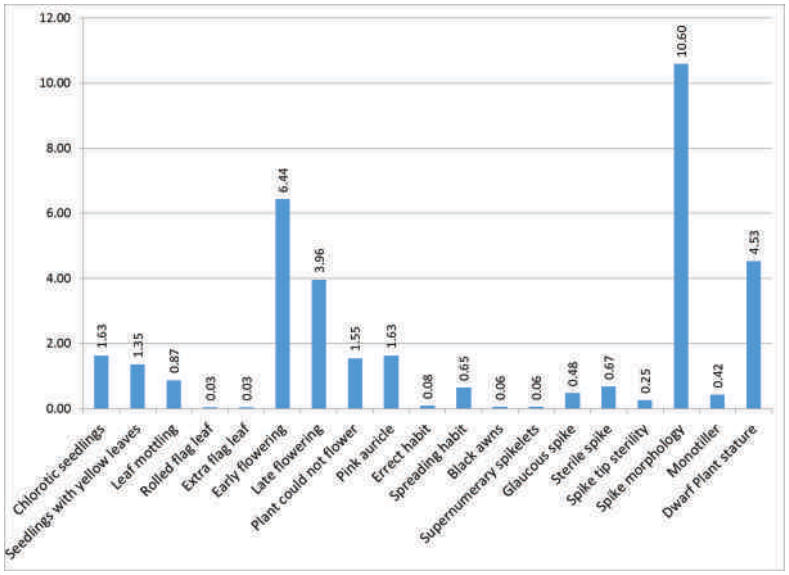


Figure 37
Frequency (%) of various Bijaga yellow mutants observed in M_2 generation

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 economic 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 cross of Bijaga yellow (Susceptible) × MACS 3125 (Resistant). In marker analysis, 192 loci were used for genetic linkage mapping. One hundred and sixty-nine markers could be assigned to linkage groups. QTL analysis using phenotype and genotype data showed presence of seven significant QTL for spot blotch resistance located on chromosome 1B, 2A, 3A, 3B and 7B.

Wheat Improvement

New wheat variety MACS 4028 notified

Wheat variety MACS 4028 (durum) for rainfed-timely sown condition in Peninsular Zone was notified in the 79th meeting of central sub-committee on crop standards, notification and release of varieties (Figure 38, 39).

Salient features of MACS 4028: High yielding (average 19.3 q/ha, with highest yield potential of 28.7 q/ha), early flowering (53 days), early maturity (102 days), semi-dwarf (75 cm), disease resistant (stem and leaf rust), bold lustrous grains (1000 grain weight 47 g), better nutritional quality (zinc 40.3 ppm, iron 46.1 ppm, high protein 14.7 %), good milling (test weight 81.6 kg/hl) and pasta making quality (6.75 out of 9).

Figure 38, 39
Durum wheat variety MACS 4028

Promising Wheat Entries

Wheat entry MACS 6709 (*Triticum aestivum*) has been promoted to first year AVT under timely sown irrigated conditions in PZ. Similarly, MACS 6696, MACS 6695, MACS 4058(d), and MACS 4059(d) are promoted under restricted irrigated conditions in PZ. These entries were significantly superior over best check MACS 6222, DBW 93 and AKDW 2997-16, with yield gain ranging from 9-22%. These entries were resistant to both stem and leaf rust under artificial conditions.

Wheat Front Line Demonstrations

Front Line Demonstrations (FLD) are organized every year with the support of Ministry of Agriculture (GOI) to popularize new wheat production technologies and varieties. During 2016-17 season 11 FLDs were conducted on 11 ha area, which included MACS 6478, HD 3090 (aestivum) (Figure 40), MACS 3949 (durum) and HW 1098 (dic) as new improved varieties against popular checks MACS 6222, NIAW 34, MACS 3125 (d), MACS 2971 (dic). The new improved technology increased yield 19 % over the check. During 2017-18 crop season, 25 FLDs of one acre each were planned in a cluster approach at Taluka Baramati, District Pune. The varieties were viz., HI 1605, HD 3090, MACS-6478, MACS 3949 (d), MACS 4028 (d) and HW-1098 (dic).

Figure 40
Front Line Demonstration of wheat variety HD 3090 at Gunawadi, Baramati

Breeder Seed Programme

During 2017-18 season 165 quintals of breeder seed was supplied to different seed multiplying agencies and farmers. For the current season expected breeder seed production is 259 quintals (Figure 41).

Figure 41
MACS 6478 breeder seed plot

Public Private Partnership (PPP) for dissemination of technology

With an objective to have more linkages with private industry, MoU for Public Private Partnership (PPP) has been signed with ITC Limited for rapid dissemination of technologies and helping for smooth flow of seed supply to industry. As a result, under the umbrella of ITC, 20 Wheat Choupal Pradarshan Khets (CPK) (8 of MACS 6222 and 12 of MACS 6478) were conducted during last season in Maharashtra (Amravati and Wardha Districts) against popular check viz. Lok-1. These varieties showed their superiority in performance over check varieties in all respects and performed well even under 3-5 irrigations. This will also help in speedy spread of new varieties/ technologies. These demonstrations clearly showed that farmers can get yield of 30-36 q/ha. The overall yield gain was 22-53 % over the check.

Exploiting wheat alien introgressions for increased photosynthetic productivity

Thinopyrum bessarbicum based wheat introgressed lines were crossed to the adopted varieties of our zone (PZ). A few of them led to fertile seeds. These F1 seeds would be further selfed and back crossed to develop genotypes with agronomical improved traits. During this period, seven F1 and six F2 combinations were grown for generation advancement. On the basis of plant type, resistant plants will be carried for further evaluation.

Soybean Improvement

Evaluation of soybean varieties in All India Co-ordinated trials

One soybean variety MACS 1493, developed at MACS-ARI, showed the highest yield of 2702 kg/ha and ranked first in trials in Southern Zone of India and gave 18 % higher yield than highest yielding check

Figure 42
Soybean variety MACS 1493

variety RKS 18 (2291 kg/ha) (Figure 42). Another variety MACS 1520 with an yield of 2372 kg/ha ranked first in two years of testing in yield trials of Central Zone and gave 20% more yield than highest yielding check variety NRC 86.

MACS 1460 showed 27% yield superiority (2035 kg/ha) over the best check in Eastern zone, 22% yield superiority (1958 kg/ha) over the best check in North Eastern Hill zone and 15% yield superiority (2253 kg/ha) over the best check in Southern zone. This variety was consistently early in maturity (89 days) and showed wide adaptability across three zones of the country. This variety has resistance to major diseases of soybean like yellow mosaic virus, pod blight (Ct), rhizoctonia aerial blight, bacterial leaf blight, charcoal rot and purple seed stain. MACS 1460 has high resistance to stem fly, pod borer and bugs. It also skows resistance to girdle beetle, white fly, defoliators, aphids, Bihar hairy caterpillar, leaf miner and leaf webber.

This variety was identified for release by the varietal identification committee for release in the states of West Bengal, Jharkhand, Chhattisgarh, Orissa, Assam and North Eastern states, Southern Maharashtra, Karnataka, Telangana, Andhra Pradesh and Tamil Nadu.

Station trials for soybean improvement

Ninety-six elite breeding lines were developed and tested in three graded replicated trials. Of these, 10 lines gave more yield than the highest yielding control variety MACS 1188 and one line MACS 1633, maturing in 90 days, gave a yield of 3391 kg/ha. It was found promising for earliness to maturity.

Agronomy research in soybean

In crop diversification trial along with different tillage systems, significantly higher seed yield in soybean-soybean-maize-soybean (3338 kg/ha) was obtained compared to pure soybean for all fours years (2988 kg/ha) and all other cropping systems. In foliar nutrition trial, foliar application of Urea 2% at pod initiation stage of the crop gave significantly higher seed yield (3338 kg/ha) over recommended dose of fertilizer (2875 kg/ha).

Resistance of MACS varieties to diseases and pests

Soybean variety MACS 1336, developed at ARI, was identified as a source for resistance to charcoal rot disease. MACS 1575 showed resistance against stem fly.

Soybean breeder seed production

270 quintals of breeder seed of soybean, including MACS 1188 and MACS 1281 varieties was supplied to public and private seed multiplying agencies and farmers. Likewise 310 quintals of breeder seed of soybean has been produced during *kharif* 2017 season.

Soybean front line demonstrations (FLDs)

Nineteen FLDs were conducted on farmers' fields in Taluka Baramati of District Pune and Taluka Phalatan of District Satara to demonstrate and evaluate the impact of improved technology (IT) over farmers ' practice (FP) using three soybean varieties viz. MACS 1281, MACS 1188 and RKS 18. Adoption of IT increased soybean yield by 23.47% over FP and gave additional net returns of Rs.11491 per hectare.

Contract research / Technology transfer

Bio-efficacy of the Torrent coated fertilizer products, developed by private industries viz. Deepak Fertilizers & Petrochemicals Pvt. Ltd., in enhancing soybean productivity were tested in field trials.

Grape Improvement

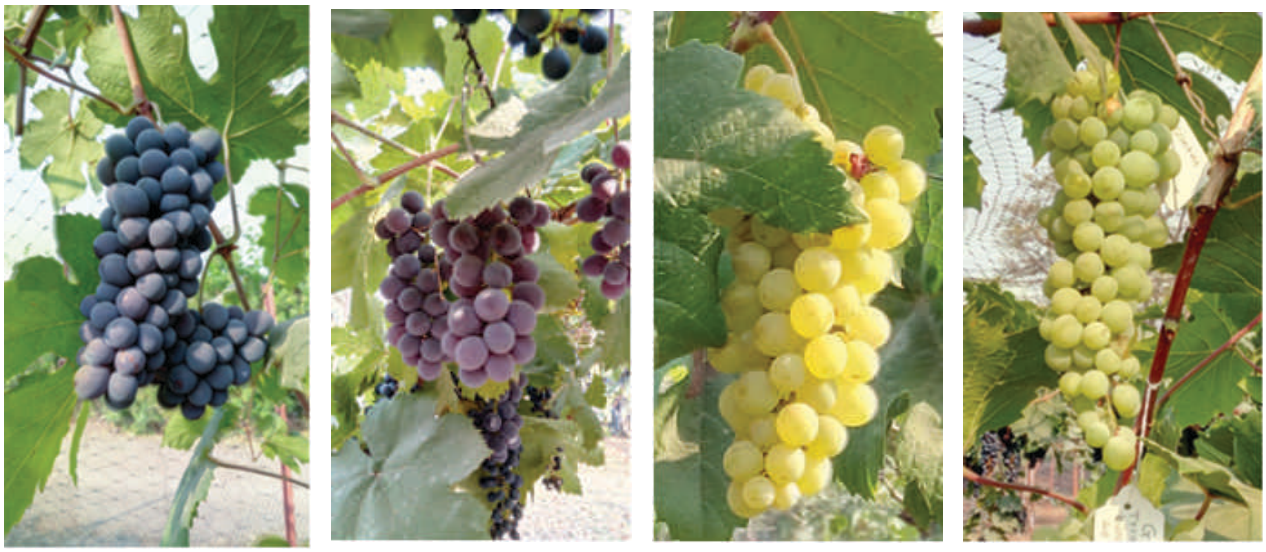
Grape germplasm: Sixty-two cultivars of *Vitis*, six rootstocks, five *Vitis species* and 25 wild species of family *Vitaceae* are being maintained under this project. IC numbers were obtained for 6 hybrids developed at ARI, 8 cultivars and 14 wild grape accessions collected from different parts of Maharashtra from NBPGR, New Delhi.

Hybridization programme: Five cross combinations were attempted using three female parents viz. James, Carolina Black Rose and Madhoo angur and two seedless male parents (Thompson seedless and Manik Chaman) to incorporate seedlessness and disease resistance in progenies. One thousand two hundred thirteen seeds derived from crossing program are being given chilling treatment for germination treatment.

Eighteen new hybrids developed earlier were evaluated for their fruit quality. Following promising hybrids were selected

i) Four Seedless hybrids having potential as table varieties (Figure 43).

1. ARI 733: Bangalore Blue x Manik Chaman
2. ARI 749: Bangalore Blue x Tas - A - Ganesh
3. ARI 833: Buckland Sweet water x Manik Chaman
4. ARI 1036: Goethe x Manik Chaman
5. ARI 1179: Khalili x Jumbo



ARI 733: Bangalore Blue x Manik chaman

ARI 833: Buckland Sweet water x Manik Chaman

ARI 117: Khalili x Jumbo

ARI 1036: Goethe x Manik chaman

△ **Figure 43**
Seedless hybrids having potential as table varieties

ii) Seeded hybrids having bold and aromatic berries:

1. ARI 1102: Catawba x Gulabi
2. ARI 1120: (Anab-e-Shahi x Catawba) x Tas-A-Ganesh

iii) Two seedless mutants of ARI 516 derived from 3 Kr gamma irradiation treatment were treated with 120 ppm of exogenous GA at 2 mm and 6 mm berry size to study the effect of PGR on berry development. There is no significant difference recorded in the berry size.

Evaluation of grape juice varieties

Six varieties including ARI 516 were planted in Randomized Block Design with 4 replications grafted on Dogridge rootstock for evaluation of berry yield, juice content quality and recovery. This trial has been planted in 2015 and in the current year first harvest was obtained.

Popularization of ARI-516

Five thousand two hundred fifty cuttings and ninety saplings of ARI 516 were sold to different grape growers in Maharashtra for cultivation in their field.

Nanobioscience Group

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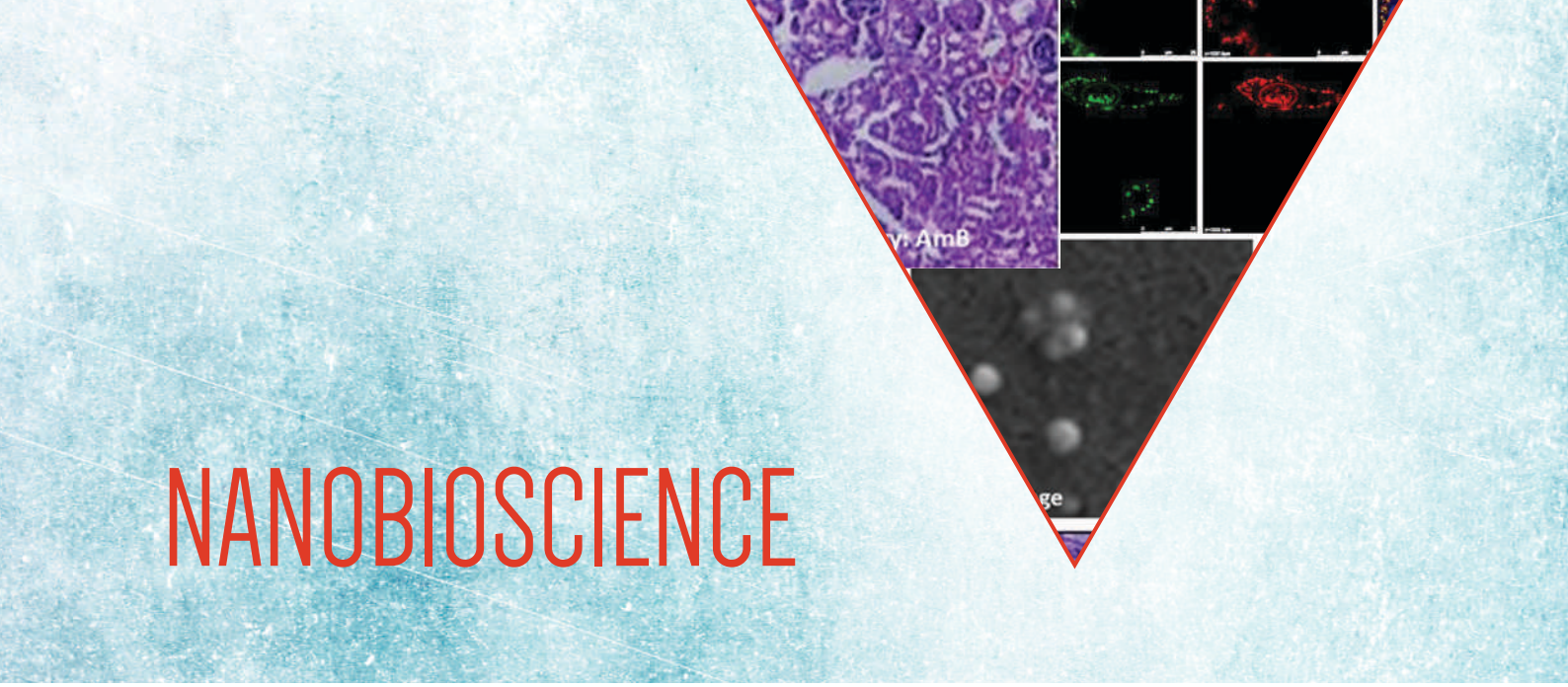


NANOBIOSCIENCE

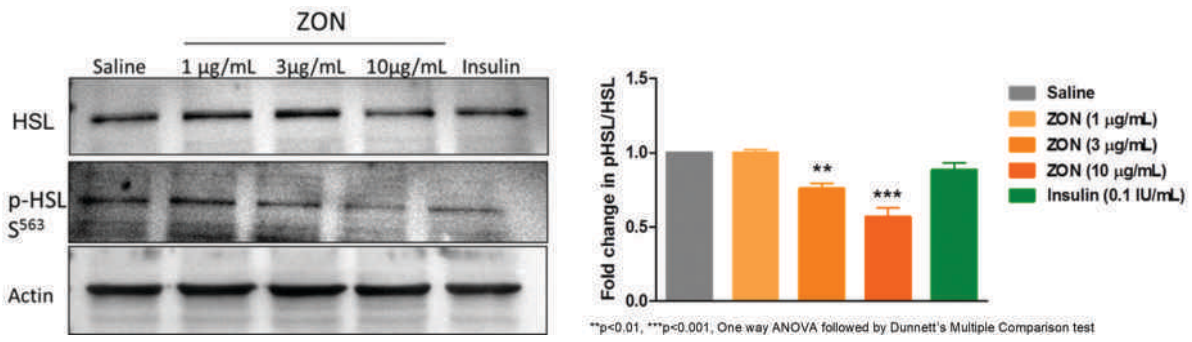
Research in Nanobioscience ranges from synthesis and characterization of nanomaterials to understanding the interactions of nanoparticles/ nanomaterials with different biological systems.

Nanomedicine

Mechanisms underlying the antidiabetic activity of zinc oxide nanoparticles

Our earlier *in vivo* studies showed that zinc oxide nanoparticles (ZON) treatment to type 1 and type 2 diabetic rats resulted in lowering of serum triglycerides and FFA levels, besides reduction of blood glucose levels. These observations led to a comprehensive investigation of the various mechanisms of antidiabetic activity of ZON on target organs. As part of this investigation, effect of ZON on lipolysis pathway was also evaluated.

A key protein in lipid metabolism is Hormone Sensitive Lipase (HSL). HSL plays a pivotal role in providing energy to most tissues, and release of free fatty acids from adipose tissue. In diabetes, the regulatory role of insulin is compromised and regulation of HSL mediated lipolysis is lost, resulting in increased FFA levels further worsening insulin resistance. Protein Kinase A increases the activity of HSL by phosphorylating it at serine 563 residue; whereas dephosphorylation leads to its inhibition and reduction of lipolysis. We therefore investigated the effect of ZON on the phosphorylation of HSL in 3T3L1 adipocytes.



△ **Figure 44**
A. Western blot image of HSL in 3T3L1 cells B. Fold change in phosphorylated form of HSL

Differentiated adipocytes were treated with ZON (1, 3, 10 µg/mL) or insulin (positive control; 0.1 IU/mL) for 24 h. HSL and p-HSL levels in cell lysates were estimated by western blotting. It was found that ZON treatment resulted in decreased phosphorylation of HSL, suggesting its inhibition and reduction of lipolysis (Figure 44). These results suggested that ZON can also exert beneficial effect in diabetic dyslipidemia.

Nano-AmB: an effective antifungal formulation with reduced toxicity

Fungal infections such as Aspergillosis and Candidiasis are silent killers causing high mortalities among the ever increasing numbers of immunocompromised (HIV, chemotherapy) and immunosuppressed (autoimmune diseases, solid organ and bone marrow transplantation) or pulmonary disease patients. Fungal pathogens causing these infections (i.e. *Candida* sp. and *Aspergillus* sp.) often show resistance to the existing antifungal azole drugs. Amphotericin B, a frontline antifungal drug currently used for treatment of fungal diseases, is known to be nephrotoxic. To overcome the issues of toxicity, solubility and biocompatibility, we developed Nano-AmB, a formulation containing AmB in polymeric nano-vehicles.

Nano-AmB was effective in control of standard and clinical strains of the human pathogenic fungus *C. albicans, in vitro* at half the dose of the bare drug and the commercial formulation. Further, Nano-Amb showed effective antifungal activity against other pathogenic yeast-like fungi like *C. tropicalis, C. parasilopsis, C. auris, C. krusei, C. glabrata* and *Cryptococcus neoformans*. Similarly, pathogenic filamentous fungi like *A. fumigatus, A. flavus* and *Penicillium marfenii* were also effectively inhibited. Furthermore, this nanoformulation showed high biocompatibility with human and mouse cell lines, and absence of hemolytic activity *in vitro*.

The Nano-AmB formulation was assessed *in vivo* using mouse model. Nano-AmB showed effective antifungal activity at half dose of free drug and the nephrotoxicity was reduced (Figure 45). Thus, Nano-AmB is a safer antifungal drug with good biocompatibility and solubility.

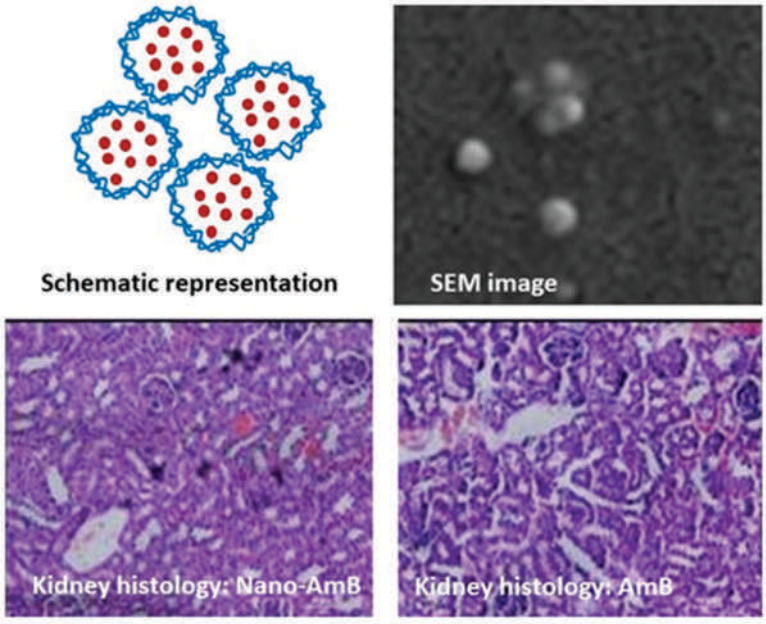


Figure 45
Nano-AmB for effective antifungal delivery and reduced toxicity. a) representative image for Nano-AmB nanoformulation encapsulating amphotericinB. b) Scanning Electron Microscopic image c) Nano-AmB showing normal kidney histology d) Amphotericin B showing abnormal kidney histology

Cyclic peptides: a therapeutic intervention for Alzheimer's disease

The aggregation of the 42-residue protein, amyloid-β 1-42 ($A\beta_{1-42}$) into amyloid fibrils is the major cause of Alzheimer's disease (AD), an incurable neurodegenerative disorder that affects millions of people worldwide. A possible therapeutic/ drug would be peptide(s) which can bind/ break the β-sheet rich oligomeric intermediates and inhibit the amyloid protein assembly. The currently available β-sheet breaker peptides (BSBPs) are designed to complement the enthalpic interactions with the aggregating protein, and entropic effects are usually ignored. Using computational studies it has been recently proposed that constrained peptide structures, in which the loss in conformational entropy during binding is rather limited, could be a new class of peptide drugs for inhibiting the amyloid protein assembly.

We developed a conformationally constrained cyclic BSBP using an unnatural amino acid and a disulfide bond. Using a battery of spectroscopic probes including transmission electron microscopy (TEM), circular dichroism and fluorescence spectroscopy, and tools of thermodynamics and kinetics we show that our peptide is a potent inhibitor of $A\beta_{1-42}$ aggregation. The BSBP stabilizes the random coil conformation of $A\beta_{1-42}$ monomers and inhibits the secondary structural transition to a β-sheet-rich conformation, which allows $A\beta_{1-42}$ to oligomerize in an ordered assembly during its aggregation (Figure 46). This cyclic peptide also rescues the toxicity of soluble aggregates of $A\beta_{1-42}$ toward neuronal cells. However, it significantly loses its potency in the conformationally relaxed acyclic form. Thus, the cyclic BSBP presents a powerful candidate for therapeutic intervention against AD and other aggregation related neurodegenerative diseases.

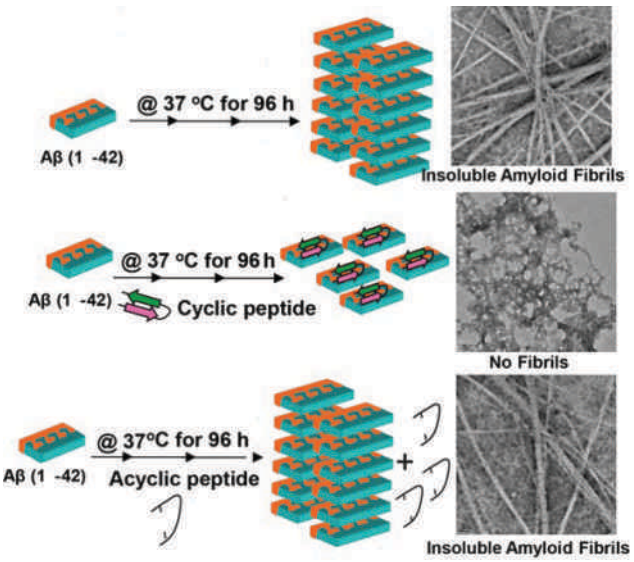


Figure 46
$A\beta_{1-42}$ peptide incubated at 37 °C for 96 h forms insoluble amyloid fibril as seen by TEM. When $A\beta_{1-42}$ peptide co-incubated with the cyclic BSBP, no such fibril formation was seen. The cyclic BSBP inhibits amyloid fibrillization. BSBP in acyclic form loses its activity, which results in the formation of amyloid fibrils of $A\beta_{1-42}$ peptide

Target specific nanoconstructs for siRNA delivery in prostate cancer cells

Prostate cancer is one of the major dreadful diseases that is being studied worldwide using siRNA-based therapies. However, siRNA based therapies pose various limitations such as off-target effects and degradation due to lack of specific delivery. To address these issues, we developed PAMAM-Histidine-PEG dendritic nanoconstructs functionalized with Triptorelin (a luteinizing hormone-releasing hormone analogue; LHRH) for targeted siRNA delivery to prostate cancer cells. Confocal microscopy showed significantly higher cellular uptake of targeted nanoparticles (NPs) in LHRH overexpressing LNCaP prostate cancer cells than non-targeted NPs. The developed nanoconstructs showed negligible

cytotoxicity and hemolytic activity with efficient siRNA loading, excellent serum stability and strongly protected siRNA from degradation. Co-localization studies in LNCaP cells further established that targeted NPs travelled through the endo-lysosomal pathway and escaped endosomes within 6 h of incubation (Figure 47). The gene silencing ability of these targeted NPs in luciferase expressing LNCaP cell showed that the targeted NPs exhibited extremely significant ($p<0.001$) silencing of luciferase gene than non-targeted NPs. Additionally, receptor blockade studies further confirmed the specificity of targeted NPs, which was evident through insignificant gene silencing in receptor blocked cells (Figure 48). The results indicated that PAMAM-Histidine-PEG-Triptorelin could be a promising approach for specific gene silencing in LHRH overexpressing cancer cells.

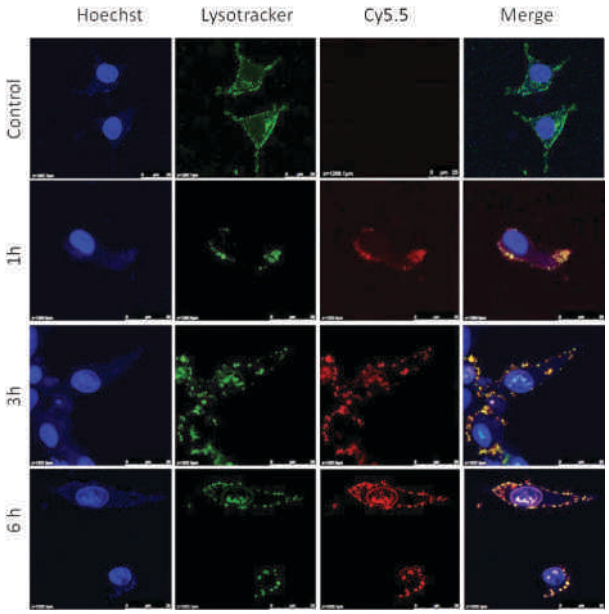


Figure 47
Colocalization of NPs in lysosomes/endosomes in LNCaP cells. Cells were incubated with Cy5.5 tagged targeted nanoparticles (Red emission), and LysoTracker marked endosome/lysosome (green emission). Yellow emission indicates colocalization. The scale bar is 25 µm

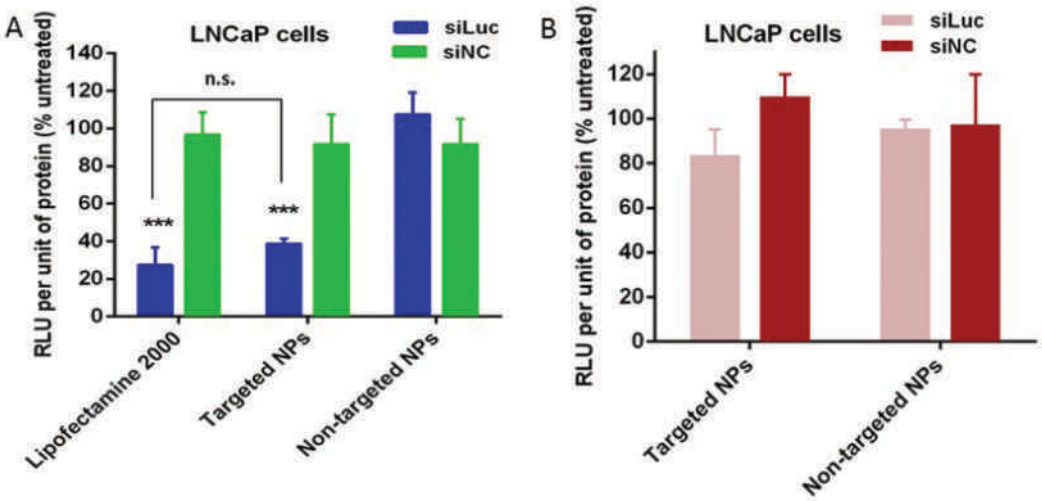


Figure 48
Luciferase gene silencing in (A) LNCaP cells with siLuc and siNC complexed with targeted and non-targeted NPs (mean ± SEM; n =6). (B) Receptor blockade studies in LNCaP cells (mean±SEM; n=3). ***$p<0.001$, n.s.= not significant

Importance of thrombin and Factor Xa in Hepatitis E virus replication

Hepatitis E virus (HEV) is a clinically important positive-sense RNA virus. A high mortality rate (~ 30%) is observed in HEV-infected pregnant women in developing countries. There is no convincing opinion about HEV ORF1 (Open Reading Frame 1) polyprotein processing owing to the variability of results obtained in earlier studies. The ORF1 of HEV encodes a nonstructural polyprotein of 1,693 amino acids. It is not clear whether the ORF1 polyprotein is processed into distinct enzymatic domains during viral replication.

We observed that the HEV pORF1 polyprotein bears conserved cleavage sites of thrombin and factor Xa (Figure 49). Using reverse genetics and biochemical approach we demonstrated that thrombin and

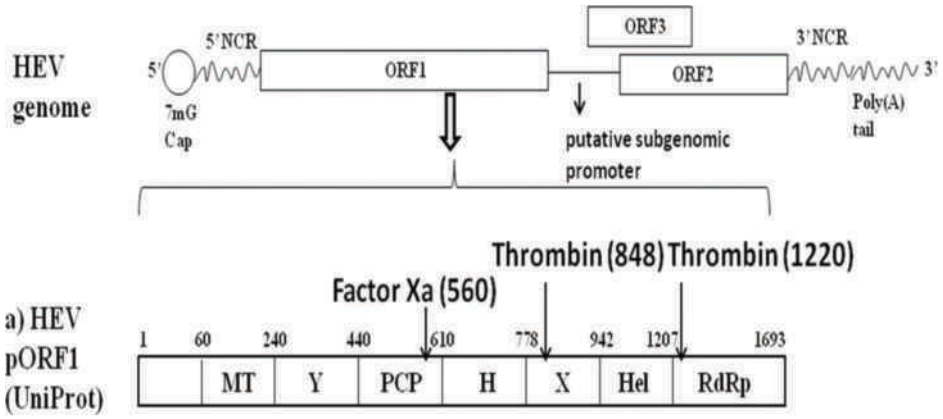
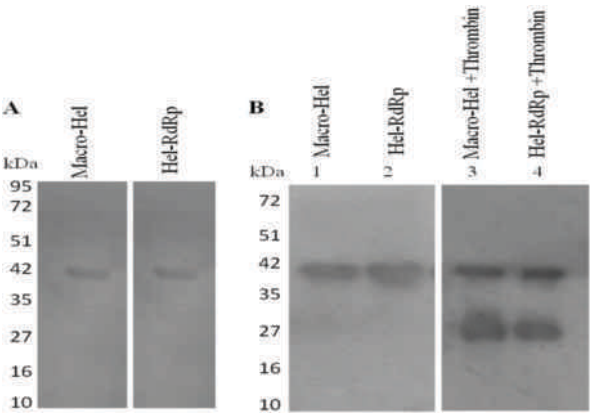


Figure 49

Schematic representation of hepatitis E virus (HEV) genome. The HEV genome consists of positive-sense single-stranded RNA which encodes three ORFs. ORF1 codes for nonstructural proteins, ORF2 codes for a structural protein, and ORF3 codes for a multifunctional phosphoprotein. Numbers denote the predicted boundaries of the different regions of the pORF (Sar55 strain of genotype 1 hepatitis E virus). Putative cleavage sites for thrombin and factor Xa are indicated by arrows on the HEV pORF1

Figure 50



In vitro digestion of pORF1 by thrombin. (A) The HEV pORF1 regions encompassing truncated Hel-RdRp and macro-Hel domains were expressed in bacteria as N-terminal 6x-His-tagged proteins of ~40 kDa. Proteins were purified using Ni-NTA affinity chromatography, and the purified proteins were subjected to 12% SDS-PAGE followed by Coomassie brilliant blue staining. (B) The expressed fusion proteins were incubated for 4 h at room temperature with bovine thrombin in thrombin cleavage buffer. Digestion of proteins in the presence of thrombin was checked with Western blotting using anti-His antibody produced in mouse. Digestion with thrombin yielded a 25-kDa band in the respective lanes

factor Xa cleavage sites on HEV pORF1 are obligatory for HEV replication. Interestingly, in this study, we demonstrated the presence of biologically active thrombin and factor Xa in a liver cell line. For the first time, this study demonstrated that thrombin and factor Xa cleavage sites on HEV pORF1 are obligatory for HEV replication (Figure 50). Intracellular biochemical activities of the above mentioned serine proteases are also essential for efficient HEV replication in cell culture and must be involved in pORF1 processing. This study sheds light on the presence and roles of clotting factors with respect to virus replication in the cells.

Antimicrobial activity and biocompatibility of nanosilver deposited dental abutments

Dental implants are extremely valuable in clinical dentistry for the functional and aesthetic rehabilitation of edentulous patients. Titanium implants are widely used in dentistry because the material is biocompatible, exhibits excellent corrosion resistance and high mechanical resistance. However, in few cases (<10%) complications such as peri-implantitis and lack of osseointegration leads to implant failure. Preventing bacterial adhesion on the abutments by providing a bactericidal activity to the biomedical device itself can be one of the strategies to prevent peri-implantitis. Surface modifications of implant materials are thought to improve success of implants.

We deposited silver on the titanium surface in a controlled manner using DC plasma. Optimum deposition of silver forming a few nanometer thin film was sufficient to inhibit bacterial growth while maintaining viability of the primary human gingival fibroblast cells. Silver-deposited titanium (Ti-Ag) showed excellent antibacterial effects on *Pseudomonas aeruginosa* and *Streptococcus mutans* at a very low concentration (Ag content 1.2 and 2.1 µg/mm^2). However, higher concentration of silver (6 µg/mm^2) was required to achieve a reduction in cell viability of *Staphylococcus aureus* and *Candida albicans*. The silver sputtered Ti abutments could maintain a long-term antibacterial activity as evidenced by the release of silver for up to 22 days in simulated body fluid. Nanoscale silver deposition thus prevented initial microbial adhesion thereby improving soft tissue integration of implant (Figure 51).

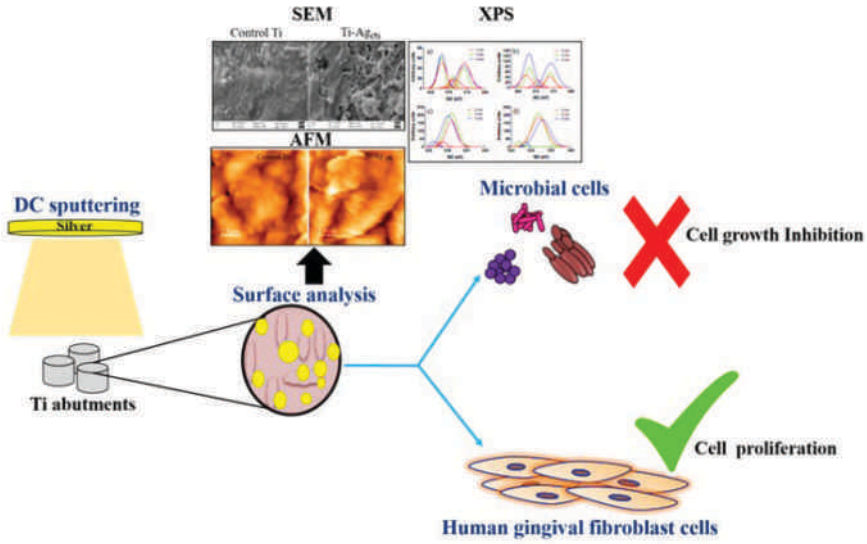


Figure 51
A schematic showing the process of surface modification of titania abutments, its characterization and biocompatibility and antimicrobial activity. Nanoscale surface modifications would prevent peri-implantitis

Nanotechnology in Agriculture

Molecular mechanisms underlying the uptake of Zn from foliar applied nanoparticles

Wheat is the staple food for most of the world's population; however, it is a poor source of zinc. Our earlier study proved that post-anthesis, foliar fertilization of zinc via zinc loaded chitosan nanocarrier (Zn-CNP) is a promising approach for grain zinc enhancement in durum wheat. The formulation and the method of application increases the fertilizer use efficiency by ~8-fold in comparison with a conventional fertilizer viz., $ZnSO_4$. However, the mechanism underlying grain zinc enrichment was poorly understood. In the present study, we tried to establish a correlation between gene expression in flag leaf and grain zinc enrichment in durum wheat. Zn-CNP application caused changes in the expression pattern of genes involved in metal homeostasis, phloem transporters, and leaf senescence (Figure 52). Furthermore, zinc-regulated transporters and iron (Fe)-regulated transporter-like protein (ZIP) family [*ZIP1*, *ZIP7*, *ZIP15*], *CA* (carbonic anhydrase), and *DMAS* (2'-deoxymugineic acid synthase) in flag leaves exhibited significant correlation with zinc content in the seeds.

At the molecular level, uptake of zinc applied in the form of Zn-CNP nanocarrier was comparable to the uptake of zinc via common zinc fertilizers i.e. $ZnSO_4$. Genotype differences [high yielding (MACS 3125 cultivar) versus high protein containing (UC1114 cultivar containing the *Gpc-B1* gene)], concentration of external zinc ions as well as the type of tissue analyzed cause variations in gene expression. The analysis of grain endosperm proteins showed enhancement of gamma gliadins while other gluten subunits decreased.

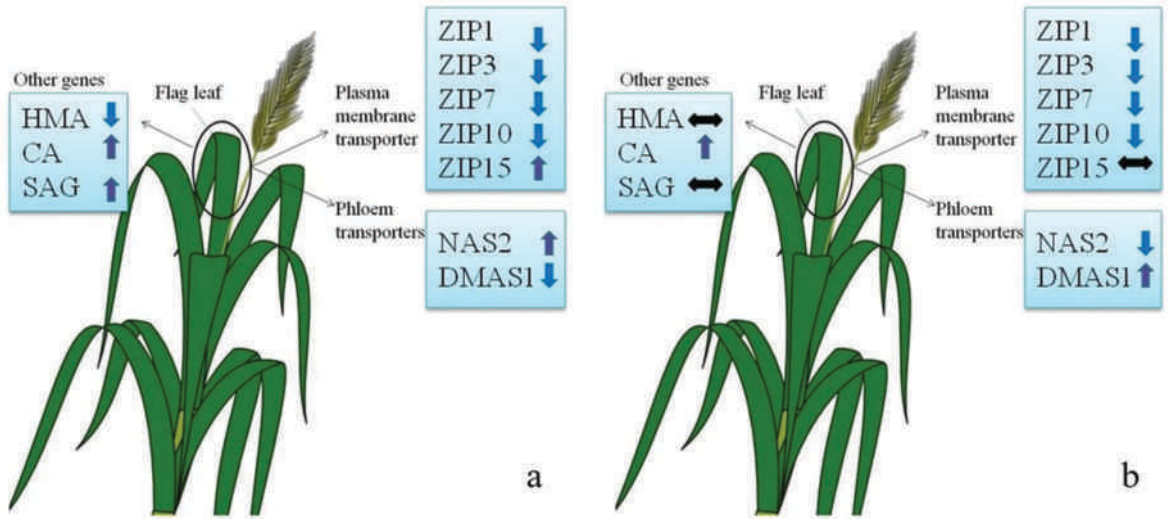


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Figure 52
Schematic showing Zn-CNP dependent changes in the overall gene expression in the two durum wheat genotypes (a) UC1114 and (b) MACS 3125 at 21 days post-anthesis

ANNEXURE

Repositories

Agharkar Herbarium at MACS (AHMA)

A total of 4132 herbarium specimens were scanned. Fifty-six specimens of bryophytes collected from Southern Western Ghats and Northern India were added to AHMA. This is the first addition of bryophytes to AHMA. Family identifiers in the form of posters have been put up on the mobile racks enabling the easy access of specimens.

Ajrekar Mycological Herbarium (AMH)

Ajrekar Mycological Herbarium holds 9963 exsiccate specimens including 102 specimens received from different centers in India for deposit and accession. In addition, 42 samples were received for identification.

Animal House

The Animal facility established in 1999, is built as per the regulatory agency's guidelines. It includes animal rooms, experimental rooms, changing room, clean and dirty corridors and utility areas. The facility is registered with the 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). Recently, the facility also received the license for i) breeding of small laboratory animals (rat and mice) for trading purpose and ii) research for commercial purpose from CPCSEA. The genetic monitoring and biochemical monitoring of laboratory animals are carried out routinely using microsatellite SSLP and biochemical markers. The health status of animals is also routinely checked by a qualified veterinarian.

This year the facility has provided animals and supported scientists and students to conduct animal experimentation for nine projects receiving intra- and extra-mural funding. Few instruments are added to the facility recently; viz., individually ventilated cages (IVC), metabolic cages, bio-safety cabinet to conduct pharmacological studies and high-end instruments such as small animal ventilator and anesthesia machine. 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 are developed in the animal facility that could be used to test various drugs and biologically active molecules. The facility can now provide the services such as supply of in-bred mice and rats, maintenance of the small animals at facility, and pharmacological and toxicological testing.

Crude drug repository

Crude drug repository hosts 1,742 specimens {1710 plant originated (1683 organized and 27 unorganized), 20 animal originated, 12 mineral originated} of plant parts used as/in medicine collected from field and or market.

Diatom Collection

Currently our diatom collection holds around 1800 samples covering the present day to early Holocene time. The samples curated in our collection mostly come from the Western Ghats, and from various projects spanning from water quality monitoring to past climatic reconstruction using diatoms.

Fossil Repository

Fossil repository hosts over 8000 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. Fifty-four specimens of ichnofossils from the Cretaceous of the Cauvery basin, Ariyalur area were added to the repository.

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, and alkaliphilic cultures.

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

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 4272. 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 112 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 and 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	27535	Maps and Atlases	567
Reference Books	1129	Microfilms / Fisches	636
PhD Theses	346	Annual Reports added	15
MSc/ MPhil Theses	97	Journals	130
ARI Reprints	3383	Digital collection/Documents	3175

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. Three hundred and twenty-eight authentication reports were generated, which included 59 for industries.

Diatom identification

Analytical service for the identification of diatoms for academic purposes was provided and 2 samples were identified.

Fungal identification service of NFCCI

Five hundred and twelve fungal cultures, other samples received from academic, research institutions and industry were authenticated/ identified. One hundred and forty-two centres, including 128 academic and research institutions and 14 private centres in India have benefited.

Technical services

Detection of bacterial spp. *Ralstonia* from ex-agar plants on semi-selective medium SMSA

Estimation of amylase from broth

Estimation of total viable count of lactobacilli and yeast from probiotic formulation

Bioactivity (Methanogenic) activity of sludge samples

Organic acid and volatile fatty acid analysis

Chlorides in ammonium perchlorate samples using Ion chromatography

Patents

Applied

Title	Number	Inventors
Polymer based nanocarrier for delivery of active ingredients, method of its preparation and applications thereof	Fa/706/MUM/2017/1813	V Ghormade, V Gajbhiye, KM Paknikar
Vinification process, apparatus set therefor, and resultant product thereof	No. IR5877; 201823003187	A Kirloskar, P Kshirsagar, P Kulkarni, S Tetali

Granted

Title	Number, date	Inventors
A process for isolation of secondary metabolite from Haloarchaeon strain IAH-1	284891 3.7.2017	SB Bhosale, D Kshirsagar

Research papers/ Monographs/ Book Chapters/ Bulletins/ Booklets

Monograph/ Book

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Papers Presented in Conferences/Symposia/ Seminars

Oral Presentations

5th Bharatiya Vigyan Sammelan (BVS), Fergusson College, Pune, 11-14 May 2017

Lomte S, Datar M and Upadhye A. *Sahyadrimadhil vanya khadya vanaspatinche sarvekshan ani tyanche vitaran nakashe*

Oak M, Patil R, Tamhankar S. *Bharatatil gavhacha vapar ani tyacha etihas*

Patil R, Oak M, Honrao BK, Tamhankar S. *Bharatiya sthanik gavhache van*: *Upayukt janukancha strot*

Salunkhe S and Kulkarni KG. The trace fossil *Siphonichnus* in the Bhadasar Formation (Tithonian) and its importance. XXVI Indian Colloquium on Micropalaeontology and Stratigraphy (ICMS-2017) University of Madras, Chennai, 17-19 August 2017

Poster presentations

33rd National Convention of Chemical Engineers for Nanotechnology and its Application for Sustainable Development in Chemical Industries, Institute of Engineers, Pune, 9-10 September 2017

Ghormade V. Nanomaterials for drug delivery

Kumbhar J. Bacterial cellulose based matrices for bio-medical applications

Kolge H. Sustainable agriculture: role of nanotechnology in dsRNA delivery for pest control

InSDB Biennial Meeting, IISER-Pune, 24-27 June 2017

Basergekar A. Investigating the role of DMon1 in regulating Glutamate receptor levels at the *Drosophila* larval neuromuscular junction

Shravage BV. Autophagy slows aging of Germline stem cells in *Drosophila*

Bali A and Shravage BV. Characterization of the Atg8a promoter in *Drosophila melanogaster*

Maurya N. Identification and analysis of glial enhancers in folded gastrulation

Shweta K. FGFR/Heartless negatively regulates Fog signaling in the *Drosophila* nervous system

Dixit NS, Shravage BV and Ghaskadbi S. Identification and characterization of autophagy related genes *Atg12* and *Atg5* from hydra

Turwankar A, Krishnapati, LS and Ghaskadbi S. Role of VEGF and FGF signaling during regeneration in hydra

International Seminar on Global Climate Change: Implications for Agriculture and Water Sectors, Aurangabad, Maharashtra, 14-16 December 2017

Bankar DN, Baviskar VS, Yashavantha Kumar KJ, Raskar SS, Khairnar SS, Gite VD, Surve VD, Bagwan JH and Honrao BK. Evaluation of wheat (*Triticum aestivum* L.) genotypes for changing climatic condition under different sowing windows in semi-arid tropics of western Maharashtra

Khairnar SS, Baviskar VS, Yashavantha Kumar KJ, Raskar SS, Bankar DN, Bagwan JH, Gite VD and Honrao BK. Evaluation of wheat genotypes suitable for different nitrogen levels on growth, yield attributes and yield of wheat under rainfed environment in peninsular zone Maharashtra

Modern Trends in Inorganic Chemistry (MTIC-XVII), SP Pune University, 11-14 December 2017

Ghatpande NS, Apte PP and Kulkarni PP. Studies on association of iron deficiency and vitamin B12 deficiency

Varma ME, Walke GR, Ranade DS and Kulkarni PP. Fluorescent copper probe inhibiting Aβ1−16-Copper(II)-catalyzed intracellular reactive oxygen species production

National Conference on Current Development and Next Generation Lichenology, January 2018

Khare R. A repository of bioactive secondary metabolites in high altitudes of Western Himalayan habitats

Gaikwad S. Lichens of the Rocky Plateaus from Western Maharashtra, India

Chikte R. Antimicrobial nanomaterials for control of bacterial blight disease in pomegranate. 2nd National Seminar cum Farmers Fair, ICAR-NRCP and Society for Advancement of Research on Pomegranate, Solapur, 28-30 April 2017

Choudhary RK. Understanding the diversification of *Eriocaulon* L. in South Asia using molecular phylogenetic approach. XIX International Botanical Conference (IBC), Shenzhen, China, 23-29 July 2017

Ghatpande NS, Misar AV and Kulkarni PP. Effect of *Guduchi* (*Tinospora cordifolia*) on inflammation associated anemia, 5th Bharatiya Vigyan Sammelan (BVS), Fergusson College, Pune, 11-14 May 2017

Jha AA. Conformationally Strained Cyclic Peptide Inhibitor of Amyloid-β Amyloidosis. 42nd Annual Meeting of the Indian Biophysical Society (IBS-2018) IISER Pune, 9-11 March 2018

Krishnapati LS, Khade S, Trimbake D, Patwardhan R, Nadimpalli SK and Ghaskadbi S. Differential expression of BMP antagonists in hydra: Antagonism between Wnt and BMP pathways. 6th International Conference on Molecular Signalling (ICMS 2018), University of Hyderabad, Hyderabad, 8-10 February 2018

Shravage SV. Autophagy delays aging of germline stem cells in Drosophila at India-EMBO Symposium Autophagy: Cellular mechanism(s) and significance in health and disease, Bhubaneswar, Odisha, 11-13 December 2017

Invited talks

Bodas DS

Microfluidics assisted detection of organisms and their components. International Workshop on Life Detection Technology: For Mars, Enceladus and beyond. Earth-Life Science Institute, Tokyo Institute of Technology, Japan, 5 October 2017

Choudhary RK

Plant interactions and symbiotic association in plants, SP Pune University, Pune, 3 March 2018 and 10 March 2018

Applications of DNA Markers and Character based methods of tree construction, SP Pune University, Pune, 15 November 2017

Basics of DNA Barcoding of Plants and Methods of Phylogenetic Tree Construction, Workshop on DNA Barcoding-Molecular Analysis and Bioinformatics Approach, Botanical Survey of India, Shillong, 21-26 August 2017

Clustering and dendrogram construction using UPGMA and NJ methods, SP Pune University, 22 November 2017

Potential of ecotourism in North East India, International Biodiversity Day Celebration, Botanical Survey of India, 22 May 2017

Datar MN

In situ conservation during the Green Skill Development Programme (GSDP), an advanced course organized for Para taxonomists, MoEF&CC, Botanical Survey of India, Pune, 26 February 2018

Ethnobotanical surveys-inventories/introduced medicinal plants of the locations, Local Health Traditions, Sacred groves and components (with special reference to Maharashtra) during Green Skill Development Programme, Advanced course for para taxonomists, Botanical Survey of India, Pune, 13 September 2017

Changing floristic diversity of Pune and factors affecting that, Symbiosis College, Vimannagar, 29 July 2017

Properties of natural resources, MES Boys High School, Pune, July 2017

Gajbhiye V

Dendritic nanoconstruct exhibits effective gene silencing in LHRH overexpressing breast cancer cells. Modern trends in dendrimer chemistry and applications. Nesmeyanov Institute of Organoelement Compounds, Russian Academy of Sciences, Moscow, Russia, 1- 4 October 2017

siRNA therapeutics and bioanalytical techniques. Biotherapeutics and Bioanalytical Techniques. DY Patil College of Pharmacy, Akurdi, Pune, 27-28 November 2017

siRNA Based Nanomedicine: Confronts, Strategies and Applications, AICTE Sponsored Quality Improvement Program (QIP). Poona College of Pharmacy, Pune, 5-17 February 2018

Ghormade V

Nanomaterials in biotherapeutics and bioanalysis. National Conference on Biotherapeutics and Bioanalytical Techniques. DY Patil College, Pune, 28 November 2017

Nanotechnologies in detection and treatment of pathogenic fungi. Yeast and Mold: Current status and perspective. Microbiology Department, SPPU, 1 February 2018

Nanoparticles in smart drug delivery. Poona College of Pharmacy, Bharati Vidhyapeeth Deemed University, Pune, 9 February 2018

Ghaskadbi S

Cell-cell signaling in hydra: Insights into evolutionarily ancient functions of signaling pathways. Indian Institute of Technology, Guwahati, 12 July 2017

Genetics. Marathi Vidnyan Parishad, YB Chavan Pratishthan, Mumbai, 18 August 2017

Evolutionary developmental biology: Understanding evolution of signaling pathways by studying pattern formation in hydra, Department of Zoology, Dharwad University, 26 September 2017

Evolution of body plan in animals: How diversity in body plans is governed by conserved molecules? Pt. Ravishankar Shukla University, Raipur, 28 December 2017

Evolution of body plan in animals. News Arts, Commerce and Science College, Ahmednagar, 2 January 2018

Hydra as a model system to study regeneration and pattern formation and Evolutionary developmental biology: studying evolution of cell signaling pathways using Hydra. Science Academies. Workshop on Current Trends in Applied Biology, Girraj Government College, Nizamabad, 17-18 January 2018

Model systems in animal developmental biology. Workshop on Developmental Biology, Vidya Pratishthan's Arts, Science and Commerce College, Baramati, 30 January 2018

Developmental biology. Modern College, Shivajinagar, Pune, January-February 2018

Identification and characterization of autophagy-related genes in hydra. 6th International Conference on Molecular Signaling (ICMS 2018), University of Hyderabad, Hyderabad, 8-10 February 2018

Hydra as a model system to study regeneration and pattern formation. St. Xavier's College, Mumbai, 14 February 2018

Discussions on organ donation (jointly with Prof. Saroj Ghaskadbi, SPPU), International Women's Day, National Centre for Cell Science, Pune, 8 March 2018

Karthick B

Application of GIS in Biodiversity Research during Green Skill Development Programme (GSDP), an advanced course for Para taxonomists organized by MoEF & CC, New Delhi, Zoological Survey of India, Pune, 19 February 2018

Diatoms, Sacred Heart College, Thevara, Cochin, 9 January 2018

Diatoms for parataxonomy. Botanical Survey of India, Pune, 22 December 2017

Application of Diatoms in Forensics, Maharashtra Police Academy, Nashik, 18 September 2017

Introduction to diatoms, classification, identification and ecosystem services. Green Skill Development Program, Botanical Survey of India, Pune, 6 September 2017

Diatoms in Water, Environment and Energy, UGC-Refresher Course in Environmental Sciences (Interdisciplinary), SPPU, 14 July 2017

Role of Bioindicators in sustainable Ecotourism, International Biodiversity Day Celebration, Botanical Survey of India, 22 May 2017

Kaushik T

Recent development in taxonomy of foraminifera: Integrated morphological and molecular approaches. The 9th Brain Storming Session (BSS) of 36th International Geological Congress (IGC), 2020, National Center for Antarctic and Ocean Research (NCAOR), Goa, 17-18 August 2017

Kulkarni KG

Crust, Ancient Life and Mineral Resources: Recent Researches and Future Challenges. National Seminar-cum-Workshop, Presidency University, Kolkata, 24-25 October 2017

Thesis writing, UGC-CE grant, Geology Department, Fergusson College, Pune, 19-20 January 2018

Londhe R

Hydra Cultivation and Regeneration, Sinhgad College of Science, Pune, 18 January 2018

Patra C

Defended proposal on genome editing, DBT, New Delhi, 16 March 2018

International Conference on Non-Mammalian Model Systems in Biomedical Research: Current Status and Future Perspectives. Nitte University, Mangalore 4 -7 October, 2017

AICTE sponsored quality improvement programme, Jadavpur University, Kolkata, 15 -18 May 2017

Paknikar KM

Geomicrobiology, Mineral-microbe interactions and beyond. International Workshop on Life Detection Technology: For Mars, Enceladus and beyond at Earth-Life Science Institute. Tokyo Institute of Technology, Japan, 5 October 2017

Rahalkar M

Methanotrophs: diversity and applications, NCL, Pune, 15 September 2017

Rajwade JM

Nanobiotechnology and its applications. 33rd National Convention of Chemical Engineers. Institution of Engineers, Pune, 9-10 September 2017

Nanocellulose and its applications. National Conference on Ingenious Trends in Life Sciences. Abeda Inamdar College, Pune, 7 October 2017

Nanotechnology and its applications in plant protection. National Symposium on Innovative approaches for Detection, Diagnosis and Management of Plant Diseases. University of Horticultural Science, Bagalkot, Karnataka, 10 October 2017

Nanocellulose and its applications in tissue engineering. Seminar on Current Trends in Life Sciences, UGC-SAP-DRS-Phase III Scheme. North Maharashtra University, Jalgaon, 3 February 2018

Applications of nanomaterials in plant pathology. National Symposium on Innovative Approaches for Detection, Diagnosis and Management of Plant Diseases. University of Horticultural Sciences, Bagalkot, 9 – 10 October 2017

Nanomaterials based field-usable diagnostics. Lecture series on Horizons of Microbiology, Abasaheb Garware College, Pune, 31 January 2018

Ratnaparkhi A

Inter-organ communication workshop, Indian Drosophila Research Conference, IISER, Bhopal, 9 December 2017

Dynamics within and across the confined cellular space, IISER, Pune, 2-3 February 2018

Sharma B

Biodiversity assessment of lichens from Andaman, Nicobar and Lakshdweep. National Conference, Current Developments and Next Generation Lichenology, Lucknow, 27-28 January 2018

Singh SK

Prospects of Microbial Resource Centers in the Era of Convention on Biological Diversity (CBD). IMTECH, Chandigarh, 26 February 2018

Advances in Systematics, Applications and Conservation of Fungi. 1st Annual Scientific summit (ABC-2018) Rajkot, Gujrat, 1-3 February 2018

Advances in Taxonomy, Conservation and Applications of Fungi. National Seminar on Advances in Plant Sciences. Savitribai Phule Pune University, 12-13 January 2018

Prospects of Bio Resource Centers in the Era of CBD. 44th Meeting of MSI and National Conference Fungal Biology: Recent Trends and Future Prospects, Jammu University, 16-18 November 2017

Relevance of Fundamental Approaches in Basic and Applied Research on Fungi. Marwadi University, Rajkot, 6 October 2017

Impact of New Concepts in Fusarium Identification and Systematics. National Conference on Emerging Trends in Mycotechnology. GM Momin Women's College, Mumbai, 5-6 January 2018

Shravage BV

Autophagy is required for stem cell maintenance and delays their aging in *Drosophila*. 8th Ramalingaswami Conclave, NIPGR, New Delhi, 15 - 17 February 2018

Upadhye AS

Plenary talk on Standardization of Medicinal Plants: Multidisciplinary approach, Yashvantrao Chavan Institute of Science, Satara, 5 January 2018

Preparation of Science Projects on the subjects, Sacred Groves, Biodiversity, Sustainable development and Traditional knowledge, Teacher's workshop, Academy of Science Council, Children Science Congress, 22 July 2017

Sacred groves and Biodiversity-Conservation, Hujurpaga Girls High School and Junior College, Pune, 21 July 2017

Umrani RD

Zinc oxide nanoparticles a potential drug for diabetes. International Diabetes Summit, Chellaram Diabetes Institute, Pune, 9-11 March 2018

Traditional medicine inspired novel drug for the treatment of diabetes, 5th Bhartiya Vigyan Sammelan. Fergusson College, Pune, 11-14 May 2017

Nanomaterial for pancreatic beta cell regeneration – new therapy for diabetes? National seminar on Biomaterials for Regenerative Medicine. DY Patil Institute of Pharmaceutical Sciences and Research, Pune, 9-10 March 2018

Nanomedicines for diabetes and cancer. MET Institute of Pharmacy, Nasik, 11 August 2017

Visits abroad

Ratnaparkhi A. Inaugural Asia-Pacific Drosophila Neurobiology Conference, Wuhan, China, 25-28 October 2017

Patra C. Max-Planck-Institute for Heart and Lung Research, Bad Nauheim, Germany, 16 October –17 November 2017

Ghormade V. Dr Dora Linda Guzman, Laboratory of Mycotoxins, Guanajuato, Mexico, 31 August–20 September 2017

Paknikar KM, Bodas DS. Mars, Enceladus and beyond at Earth-Life Science Institute, Tokyo Institute of Technology, Japan, 2–7 October 2017

Gajbhiye V. AN Nesmeyanov Institute of Organoelement Compounds, Russian Academy of Sciences, Moscow, Russia, 1-4 October 2017

Karthick B. Tokyo Gakugei University, 8-17 May 2017

Kulkarni KG. Jagiellonian University, Krakow, Poland,15-25 May 2017

PhD awards

(Guide, Co-Guide, Student, Title)

Candidate	Title	Guide
Ranade D	Metal ion induced oligomerisation and toxicity of amyloid beta peptide	Kulkarni PP
Walke G	Studies of metal complexes of peptides involved in neurological diseases and their interactions with bioactive molecules	Kulkarni PP
Asani S	Mechanistic studies on anti-diabetic action of zinc oxide nanoparticles.	Paknikar KM Umrani RD

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Candidate	Title	Guide
Kumbhar J	Developing bacterial cellulose nanocomposites as scaffolds for osteochondral tissue engineering	Rajwade JM Paknikar KM
Kulabhusan P	Phage display peptides for detection of white spot syndrome virus (WSSV)	Paknikar KM Rajwade JM

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

Choudhary RK

Maurya S. Biogeography, diversification and molecular phylogenetics of genus *Capparis* L. in the Indian subcontinent

Datar MN

Kulkarni A. Plant life between inundation and desiccation: a study on rock outcrops of Northern Western Ghats, India

Vijayan S. Study of cliff dwelling vascular chasmophytes from Northern Western Ghats with special emphasis on desiccation tolerant species

Dagar SS

Deore K. Thermophilic methanogenic archaea from hot springs and oil reservoirs, and their application.

Gaikwad S. Bacteriophages for inhibition of sulfate reducing bacteria associated with oil reservoir souring

Dhakephalkar PK, 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

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/ physico-chemical pretreatment for enhancement of biogas production from rice straw

Kapse N. Influence of microbial metabolism and reservoir properties on enhanced oil recovery: Insights from simulated laboratory studies

Gajbhiye V, Paknikar KM

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

Ghaskadbi SM, Patwardhan VG

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*

Ghaskadbi SM, Paknikar KM

Dixit N. Analysis of autophagy in hydra

Ghormade V

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

Patil G. Development of chitosan based hydrogels for rapid hemostasis

Rahi S. Rapid detection of mycotoxins for ensuring food safety

Jha A, Paknikar KM

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

Karpe Y

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

Patil R. Roles of microRNAs in Hepatitis E virus replication

Pingale K. Interaction of Hepatitis E virus RNA dependant RNA polymerase with host cell proteins

Kulkarni KG

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

Salunkhe S. Ichnological studies of the late Oxfordian-Kimmeridgian Baisakhi Formation, Jaisalmer Basin, Rajasthan, India.

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

Karthick B

Thacker M. Diatoms as indicators of environmental and climatic changes in the *Myristica* swamps of the Western Ghats

Kulkarni PP

Ghatpande N. Development of nutraceuticals for the treatment of inflammation associated anemia

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

Sharma S. Maternal calcium metabolism and its relation with metabolic syndrome in rat adult offspring

Paknikar KM, Bodas DS

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

Paknikar KM, Ghormade

Raval K. Studies in immunodiagnosis of invasive Aspergillosis

Paknikar KM, Umrani RD

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

Paknikar KM, Rajwade JM

Madiwal V. Nanoscale surface modifications of dental materials for preventing implant related failures.

Jamalpure S. Development of a multiplexed, point-of-care (POC) diagnostics for the detection of viral pathogens affecting shrimp and prawns

Rajwade JM, Paknikar KM

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

Rajwade JM

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

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

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, Patra C

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

Rahalkar MC

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

Khatri K. Conversion of methane to biodiesel using methanotrophs

Mallick S. Isolation and characterization of methanogens from Martian analogues in Ladakh region

Srivastava P

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

Shravage BV

Murmu N. Determine the role of autophage in germline stem cell aging in *Drosophila*

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 *Brihati* complex

Workshops organised

National Workshop/ Certificate course

Taxonomy, Biodiversity, Ex situ Conservation and Applications of Fungi. Batch-I, 22-31 May 2017; Batch-II, 21-30 November 2017

Functions

National Technology Day

17 May 2017

Science and Entrepreneurship in India: To be/ not to be

Dr Ulhas Kharul, Scientist, Polymer Science and Engineering, CSIR-National Chemical Laboratory, Pune

Exhibition on Science and Technology Innovations

28 July – 11 August 2017

Smt. Renuka Chowdhury, Parliamentary Standing Committee on Science & Technology, Environment & Forests, GoI

Giriraj Singh, Minister of State for Micro, Small and Medium Enterprises, GoI

Sumitra Mahajan, Speaker, Lok Sabha

Vandana Chavan, MP, Rajya Sabha

Kisan Mela

10 August 2017

Twenty farmers were trained in improving soybean cultivation technology during *kharif* 2017 as a part of the frontline demonstrations, at Hol farm on.

Teachers' Training

22 August 2017

Dr. Prasad Kulkarni (Mole concept, pH),

Dr. Jyutika Rajwade (Electromagnetism),

Dr. Dhananjay Bodas (Concept of light and lenses)

Dr. Ravindra Patil (Mapping of genes)

Thirty-one school teachers of Maharshi Karve Stree-Shikshan Sanstha, Pune were given detailed information on various topics related to their school syllabus to aid them in simplifying the subjects while teaching in their schools.

New wheat variety released

Wheat variety MACS 3949 (durum) for irrigated-timely sown condition in Peninsular Zone was released by the Central Varietal Release Committee [notification S.O.1007(E), 30 March 2017] at the 56th All India Wheat and Barley Research Worker's Meet, held at BHU-Institute of Agricultural Sciences, Varanasi, 25-28 August 2017. Shri Radha Mohan Singh, Union Minister of Agriculture and Farmers Welfare, GoI, felicitated Dr. BK Honrao, Scientist, MACS-ARI and presented him with a memento on this occasion.

Public Outreach Day

15 September 2017

"Science research institutes must share their expertise with school children to nurture their curiosity", said Mrs. Mukta Tilak, Mayor, Pune Municipal Corporation.

On the occasion Mrs. Meenakshi Raut, Mrs. Manjushri Khardekar, Mrs. Vinita Phaltane, Mr. Hemant Pathak and Mr. Mayuresh Prabhune were felicitated for their contribution in furthering education.

The science exhibition included exhibits of medicinal plants, fossils, diatoms, lichens, zebrafish, drosophila, hydra, nanotechnology, bioenergy, bioprospecting, developmental biology, varieties of wheat, soybean, and grapes.

Lectures on fossils and fossilization, Plant diversity of the Sahyadris, Mapping of genes were delivered by scientists Kantimati Kulkarni, Mandar Datar and Ravi Patil.

Students of Hujurpaga High School, Boys High School Perugate, Chandrakant Darode School and Ramanbaug High School participated in the exhibition.

ARI Director Dr. Kishore Paknikar disclosed that the science exhibition was organized as a precursor to the 3rd India International Science Festival (IISF) to be held at IIT Madras from 13-16 October 2017, in which six ARI young scientists working on bioenergy, crop hybridization, zebrafish, plant diversity, and viruses would be participating.




Hindi Day Programme

1-15 September 2017

राजभाषा का दर्जा 2017-18

भारत सरकार के राजभाषा सम्बंधी आदेशों का अनुपालन करने के लिए हमारे संस्थान में निम्नलिखित प्रयास जारी हैं।

- नगर राजभाषा कार्यान्वयन समिति की बैठक म नियमित रुप से भाग लिया जाता है।
- हिन्दी समिति का गठन किया गया है।
- राजभाषा संबंधित निर्देशों से सभी विभाग/ प्रभाग प्रमुखों को अवगत कराया जाता है।
- प्रवेशव्दार पर संस्थान का नाम हिन्दी में लिखा है।
- संस्थान के मुख्य भवन में हर रोज आज का शब्द'' (हिन्दी तथा अंग्रेजी) में लिखा जाता है। हिन्दी शब्दों से परिचित करवाने हेतू हर रोज एक हिन्दी शब्द और उसके अंग्रेजी समशब्द का प्रदर्शन।
- हर वर्ष वार्षिक प्रतिवेदन का प्रकाशन हिन्दी और अंग्रेजी में किया जाता है।
- संस्थानकी वेब साइट हिन्दी तथा अंग्रेजी में है।
- कम्प्यूटरों पर सारांष हिन्दी सॉफ्टवेअर का उपयोग किया जाता है।
- राजभाषा अधिनियम 1963 की धारा 3(3) के तहत परिपत्र, सामान्य आदेश, ज्ञापन, संकल्प, अधिसूचनाएं, नियम, करार, संविदा, टेंडर नोटिस, संसदीय प्रश्न आदि हिन्दी में भेजे जाते है। संस्थान से भेजे जानेवाले पत्रोंमें हिन्दी में पत्राचार बढ़ाने पर विशेष जोर दिया जाता है।
- संस्थान में भिन्न सभाओं का कार्यवृत्त हिन्दी में बनाया जाता है।
- संस्थानको प्राप्त तथा संस्थानसे जानेवाले सभी पत्रोंकी प्रविष्ठियाँ हिन्दी में की जाती है। क,ख, ग क्षेत्रों को भेजे जानेवाले पत्र तथा इन क्षेत्रों से पाए जानेवाले पत्र की कुल संख्या जानने हेतु स्टैम्प बनाया गया है।
- साइनबोर्ड, नाम–पट्ट तथा रबर की मोहरे व्दिभाषी है।
- वैज्ञानिक और कर्मचारियोंकों अपनी टिप्पणियाँ हिन्दी में लिखने के लिए प्रोत्साहित किया जाता है।
- उपस्थिति रजिस्टर पर हिन्दी में हस्ताक्षर किए जाते है।
- आवदेन पत्र हिन्दी में लिखे जाते है।

- मिसिलों पर संख्या और नाम हिन्दी में लिखे जाते है ।
- सेवा–पंजी पुस्तिका में अवकाश की प्रविष्टियाँ हिन्दी में लिखी जाती है।
- ''राष्ट्रीय विज्ञान दिवस'' के दौरान आयोजित प्रदर्शनी में हिन्दी का उपयोग अधिकाधिक किया जाता है।
- सीएसआईआर–राष्ट्रीय रासायनिक प्रयोगशाला में हिन्दी पखवाड़ा के अंतर्गत शुध्दलेखन प्रतियोगिता के आयोजन में आघारकर अनुसंधान संस्थान से श्रीमती मंजुषा तिवारी को निर्णायक के रुप में बुलाया गया था।
- प्रसार भारती, आकाशवाणी पुणे से हिन्दी पखवाड़ा 2017 के उपलक्ष्य में नगर राजभाषा कार्यान्वयन समिति व्दारा संयुक्त रुप से हिन्दी काव्य वाचन प्रतियोगिता में श्रीमती मंजुषा तिवारी और श्री. अजय लगशेटटी को नामित किया गया था। जिसके लिए उन्हे प्रमाणपत्र मिला है।
- हिन्दी दिवस और पखवाड़े का आयोजन किया है। इसका वर्णन निम्नानुसार है।
- हिन्दी पखवाड़ा

विगत वर्षों के भांती इस वर्ष भी संस्थान में राजभाषा के प्रोत्साहन के लिए हिन्दी दिवस और हिन्दी पखवाड़े का आयोजन बड़े उत्साह से किया। इस के अन्तर्गत संस्थान के वैज्ञानिकों, कर्मचारियों एवं समस्त शोध छात्र–छात्राओं के लिए विभिन्न कार्यक्रम आयोजित किए गयें जो निम्नलिखित है।

- व्याख्यान
- शोधकार्यों का हिन्दी में प्रस्तुतिकरण
- निबंध प्रतियोगिता: विषय – मेक इन इंडिया
- वाद–विवाद/ विचारोंकी अभिव्यक्तिः विषय– उच्च शिक्षा बनाम कौशल विकास
- स्वरचित कविता पाठ, चुटकुले एवं हिन्दी गाने

संस्थान में 1 से 15 सितंबर 2017 तक हिन्दी पखवाड़ा मनाया गया। संस्थान के मुख्य व्दार पर बैनर लगाके हिंदी पखवाड़े का आरंभ हुआ। पखवाड़े के दौरान संस्थान में सभी कर्मचारियोंने बहुतांशी हिंदी में वार्तालाप करने पर विशेष ध्यान दिया।

डॉ. रितेश कुमार चौधरी

डॉ. रितेशकुमार चौधरी ने हिन्दी पखवाड़ा मनाने की पार्श्वभुमी पर संक्षिप्त में भाषण देकर कार्यक्रम की शुरुवात की।

11.9.2017 को शोधकार्यो का हिन्दी में मौखिक प्रस्तुतिकरण कार्यक्रम हुआ। इस में 5 छात्रों ने सहभाग दिया। सभी प्रतिभागियोंने अपने–अपने शोध कार्यों के बारे में पावर प्वाइंट में 15 मिनट का प्रस्तुतिकरण दिया । सभी प्रतिभागिताओंका प्रस्तुतिकरण सराहनीय था।

कुमारी श्वेता

प्रथम विजेता के लिए रुपए 1500, व्दितीय विजेता के लिए रुपए 1000 और तृतीय विजेता को रुपए 750 का नकद पुरस्कार रखा गया। कुमारी श्वेता को प्रथम पुरस्कार, तथा अजय लागशेटटी और कुमल खत्री को व्दितीय और तृतीय पुरस्कार दिया गया।

संस्थान में आज का हिन्दी शब्द और उसका अंग्रेजी प्रतिशब्द लिखना जारी था।

डॉ. प्रतिभा श्रीवास्तव

13 सितंबर 2017 को वाद–विवाद, काव्य वाचन, हिन्दी गाने, हास्य–व्यंग, और चुटकुले का आयोजन किया था।

डॉ. (श्रीमती) प्रतिभा श्रीवास्तव ने हिन्दी दिवस तथा पखवाड़ा मनाने में आनेवाली तृटियों के बारे में चर्चा की और उस पर अंमल करने के मुद्योंपर चर्चा करके अगला कार्यक्रम शुरु हुआ।

कार्यक्रम के शुरु में वाद–विवाद प्रतियोगिता का आयोजन किया गया। दो प्रतिभागियोंने भाग लिया था। दोनो की प्रस्तुती सराहनीय रही। प्रथम पुरस्कार निनाद पुराणिक और दुसरा पुरस्कार दीपक कुमार मौर्य को मिला।

पखवाड़े के दौरान निबंध प्रतियोगिताका आयोजन हुआ। निबंध का विषय मेक इन इंडिया था। इसमें कुल 11 प्रतिभागियोंने भाग लिया। सभी के निबंध सुलिखित और प्रभावशाली थे।

निबंध प्रतियोगिता के पुरस्कार जीतने में संस्थानके महिलाओंने बाजी मारी। तिन्हो विजेती महिला है। कोमल तिकोने को प्रथम, स्नेहा लाड को व्दितीय और आसावरी कुलकर्णी को तृतीय पुरस्कार मिला। पुरस्कार की राशी अनुक्रमे रुपये 1000, 750 और 500 थी।


दर्शक

आगे के कार्यक्रम में कविता पाठ, हिंदी गाने, हास्य व्यंग और चुटकुले प्रस्तुत हुए।

इस कार्यक्रम में लगभग 10 प्रतिभागी थे। सभी श्रोतागण ने मंत्रमुग्ध होकर कार्यक्रम का आनंद उठाया।

पखवाड़े के आखिरी में व्याख्यान और पुरस्कार वितरण समारोह हुआ।

डॉ. तुषार कौशिक ने कार्यक्रम की सुची प्रस्तुत की ।


डॉ. तुषार कौशिक

हिंदी दिवस हेतु दिनांक 15 सितंबर 2017 को राष्ट्रीय रासायनिक प्रयोगशाला के सेवानिवृत्त हिन्दी अधिकारी डॉ. रमाशंकर व्यास का व्याख्यान रखा गया। व्याख्यान का विषय था हिंदी का राजभाषा के रुप में संवैधानिक महत्व और उसकी पृष्ठभूमी।

डॉ. रमाशंकर व्यास ने बहुतही सरलता से हिंदी का महत्व बयान किया। सभी श्रोताओं ने उत्सुकता से व्याख्यान सुना। डॉ. रमाशंकर व्यास ने बताया कि हमारे देश की संस्कृति हिन्दी भाषा से जुड़ी है। देश


संस्थान के निदेशक डॉ. के.एम. पाकणीकर और व्याख्याता डॉ. रमाशंकर व्यास।

की प्रगति और हमारे संस्कार दोनो भिन्न होते हुए एकसाथ रखना हम सबकी जिम्मेवारी है। नई पिढी भविष्य की मजबूत सीढ़ी है। डॉ. रमाशंकर व्यास का व्याख्यान अत्यंत प्रभावी और प्रेरणात्मक था।

हिन्दी कार्यान्वयन समिति अध्यक्ष डॉ. संजय सिंह ने सभी प्रतिभागियों की सराहना की।

पखवाड़े दौरान आयोजित सभी कार्यक्रम में संस्थान के निदेशक डॉ. किशोर पाकणीकर को संपूर्ण योगदान रहा। निबंध का विषय, वाद–विवाद का विषय निदेशक महोदय ने तय किये थे। निदेशक महोदय ने बताया कि हिन्दी को बढ़ावा देने के लिए शब्दों का ज्ञान बढ़ाना आवश्यक है, पुस्तकें पढ़ना आवश्यक है। जिसके पास भरपूर शब्द संग्रह है उसे हिन्दी में कामकाज करने में कभी समस्या आएगी ही नहीं।

निदेशक महोदय के विचारों को महत्व देने हेतु विभिन्न प्रतियोगिताओं के विजेताओं को व्याख्याता डॉ. रमाशंकर व्यास के हाथों पुरस्कार राशी, प्रशस्तीपत्र और पुस्तकें भेंट दी गई ।

उपरोक्त सभी कार्यक्रम का सूत्र संचलन प्रशासन विभाग की श्रीमती मंजुषा तिवारीने किया ।

इसी के साथ हिन्दी पखवाड़ा 2017 कार्यक्रम का समापन हुआ।

- इसके अतिरिक्त आघारकर अनुसंधान संस्थान में 5 सितंबर 2017 से 2 अक्टूबर 2017 तक स्वच्छता ही सेवा अभियान का अंमल किया गया। घोषवाक्य और पोस्टर प्रतियोगिता का हिन्दी में आयोजन हुआ।
- संस्थान के विद्यार्थियोंने स्वच्छता पर हिन्दी में लघुनाटय प्रस्तुत किया।
- कार्यक्रम का संपूर्ण संचालन हिन्दी में किया गया।

डॉ. संजय सिंह

श्रीमती मंजुषा तिवारी

India International Science Festival

13-16 October 2017

Six scientists participated in Sensitizing Youth to Flagship Programmes of the Government of India, Young Scientist Conclave (SYPOG), IISF, 2017 at Anna University Chennai,

Vigilance Awareness Week

30 October – 4 November 2017

Lecture, 3 November 2017

My Vision – Corruption Free India

Shri PN Hasabnis
Additional Superintendent of Police
Anti-Corruption Bureau, Maharashtra State, Pune

Dr SA Tamhankar, Vigilance Officer, ARI administered the 'Integrity Pledge' to staff and students of ARI.

Shri AM Chavan, Scientist, administered the pledge at the institute's experimental farm at Hol-Sortewadi, Taluka Baramati, District Pune

Shri VD Surve, Technical Officer B, administered the pledge at the institute's experimental farm at Songaon, Taluka Baramati, District Pune

Dr GB DEODIKAR MEMORIAL ORATION

17 November 2017

Earth System Science

Prof. Dr. Nitin R Karmalkar
Vice-Chancellor, Savitribai Phule Pune University, Pune

Shri GB JOSHI MEMORIAL ORATION

17 November 2017

Molecular marker assisted selection for wheat improvement

Dr. KV Prabhu
Joint Director (Research), ICAR-IARI, New Delhi

57th Prof. SP AGHARKAR MEMORIAL ORATION

18 November 2017





Navigating Scientific Complexity by Common Sense

Prof. Dr Ashutosh Sharma

Secretary to the Government of India, Ministry of Science and Technology, Department of Science and Technology, New Delhi

Shri VP Gokhale Prize

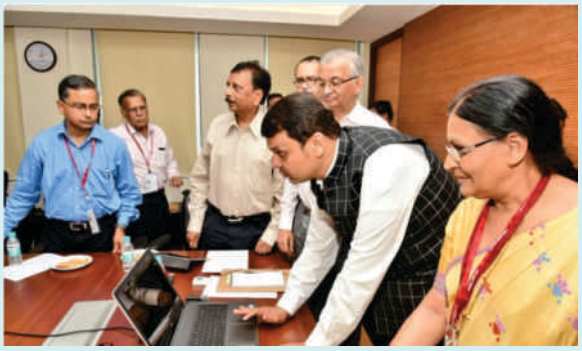
Dr. Rukam Singh Tomar

Dr RB Ekbote Prize

Dr. NK Singh

Dr. PP Kanekar Award

Dr. Virendra Gajbhiye



Book Release

22 February 2018

Honourable Chief Minister of Maharashtra Shri Devendra Fadnavis released the Medicinal Plants Database of Maharashtra, both in the digitized and print form, in a function at the Secretariat, Mumbai, on 22 February 2018.

National Science Day programme

28 February - 1 March 2018




Indian Science Congress

Imphal, 16-18 March 2018

Dr KM Paknikar, Dr RK Choudhary and Dr Mandar Datar participated.

Open House

An Open House was organized on the occasion of the National Science Day for students and citizens on Wednesday, 28 February 2018, from 9.30 am to 5 pm. Exhibits on display included fossils, hybrid crops, medicinal plants, fungi and lichens. Exhibits under 'Innovate in India', 'Swastha Bharat', 'Clean India' included products developed using nanotechnology, a method to detect viral infection in shrimps, a mobile application to measure blood haemoglobin, processes for microbial degradation of human and agricultural wastes, research on drosophila, hydra and zebrafish.






Science Exhibition

28 February-1 March 2018

GMRT, Khodad, Narayangaon

Kisan Mela

28 February 2018

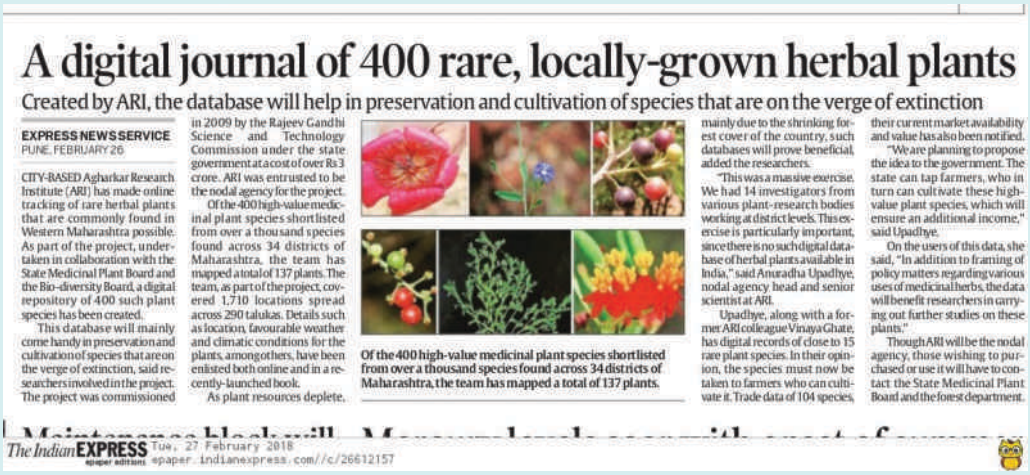
A Farmers Meet was organized at the Songaon farm. Thirty farmers from nearby villages participated. Fifty girl students with faculty from Agriculture College, Malegaon visited the farm and saw wheat breeder seed plots and other experiments.

Dr BK Honrao, Dr VS Baviskar, AM Chavan, VD Surve and other staff members explained about the research on wheat, soybean and grape, cultivation practices etc. The meet ended with a visit to the wheat breeder seed plots.


Press Clippings

57TH PROF S P AGHARKAR MEMORIAL ORATION

'R&D-industry-academia correlation must'



A digital journal of 400 rare, locally-grown herbal plants

Created by ARI, the database will help in preservation and cultivation of species that are on the verge of extinction

EXPRESS NEWS SERVICE
PUNE, FEBRUARY 26

CITY-BASED Agharkar Research Institute (ARI) has made online tracking of rare herbal plants that are commonly found in Western Maharashtra possible. As part of the project, undertaken in collaboration with the State Medicinal Plant Board and the Bio-diversity Board, a digital repository of 400 such plant species has been created.

This database will mainly come handy in preservation and cultivation of species that are on the verge of extinction, said researchers involved in the project. The project was commissioned in 2009 by the Rajeev Gandhi Science and Technology Commission under the state government at a cost of over Rs 3 crore. ARI was entrusted to be the nodal agency for the project.

Of the 400 high-value medicinal plant species shortlisted from over a thousand species found across 34 districts of Maharashtra, the team has mapped a total of 137 plants. The team, as part of the project, covered 1,710 locations spread across 290 talukas. Details such as location, favourable weather and climatic conditions for the plants, among others, have been enlisted both online and in a recently-launched book.

As plant resources deplete, mainly due to the shrinking forest cover of the country, such databases will prove beneficial, added the researchers.

"This was a massive exercise. We had 14 investigators from various plant-research bodies working at district levels. This exercise is particularly important, since there is no such digital database of herbal plants available in India," said Anuradha Upadhye, nodal agency head and senior scientist at ARI.

Upadhye, along with a former ARI colleague Vinaya Ghate, has digital records of close to 15 rare plant species. In their opinion, the species must now be taken to farmers who can cultivate it. Trade data of 104 species, their current market availability and value has also been notified.

"We are planning to propose the idea to the government. The state can tap farmers, who in turn can cultivate these high-value plant species, which will ensure an additional income," said Upadhye.

On the users of this data, she said, "In addition to framing of policy matters regarding various uses of medicinal herbs, the data will benefit researchers in carrying out further studies on these plants."

Though ARI will be the nodal agency, those wishing to purchased or use it will have to contact the State Medicinal Plant Board and the forest department.

Of the 400 high-value medicinal plant species shortlisted from over a thousand species found across 34 districts of Maharashtra, the team has mapped a total of 137 plants.

The Indian EXPRESS Tue, 27 February 2018
epaper editions epaper.indianexpress.com//c/26612157

Science & tech dept to take 50,000 girls under its wing

Ardhra.Nair@timesgroup.com

The 57th Prof S P Agharkar Memorial Oration was held at the Agharkar Research Institute on Saturday

Pune: Next year onwards, the Department of Science and Technology (DST) will mentor thousands academically proficient girls to help them gain admission into the National as well as Indian institutes of technology.

Around 50,000 girls currently in Class X, who will achieve top ranks in their respective boards, will be chosen under this programme, DST secretary Ashutosh Sharma said at the 57th Prof S P Agharkar Memorial Oration at Agharkar Research Institute on Saturday.

Sharma said pilot projects were already running in small clusters across the country and rued the less-than-10% strength of girl students in IITs and said India needs more women in leadership roles. "This will not be a typical coaching class method. Instead, science camps will be held for the chosen students. These camps will help them strengthen their basics and also guide their preparation. There will be regular, at most monthly camps, so by the time they have to appear for entrance exams, the maximum number of girl students get through," Sharma said, adding that students will be selected purely on merit.

Meanwhile, Sharma said the department will write to the HRD ministry to revise its technology curricula to include machine learning, big data et al. "We write to the All India Council of Technical Education and University Grants Commission to include topics like machine learning, deep learning, artificial intelligence, bigdata, etc in the syllabus. We will be setting up various centres in this regard, and will work closely with the HRD ministry for better manpower and research and development," Sharma further said.

Predicting cyber warfare as the thing to watch out for, Sharma stressed on the need to increase manpower and improve R & D and technology in this field. "Cyber physical systems is the next big thing, and we cannot miss that," he said.

Sharma also touched upon need for scientific manpower, resources, centres of knowledge, basic and translational R & D. "Instead of just learning about the systems," Sharma said, "there is a need to look at common intuition too."

'शास्त्रज्ञांनी वस्तुस्थिती पाहावी'

म. टा. प्रतिनिधी, पुणे

देशभरातील अनेक शास्त्रज्ञांनी रस्त्यावर उतरून केंद्राच्या अनास्थेला लक्ष्य केल्याच्या घटनेला तीन महिने उलटून गेल्यानंतर सरकारने शास्त्रज्ञांच्या प्रश्नांवर काहीच भूमिका घेतलेली नाही, मात्र, केंद्राच्या विज्ञान-तंत्रज्ञान विभागाचे सचिव डॉ. अशुतोष शर्मा यांनी शनिवारी शास्त्रज्ञांच्या अंदोलनामागचे पोलताना विज्ञान-तंत्रज्ञान विभागाचे बजेट गेल्या तीन वर्षांत दुप्पट केल्याचा दावा केला. आंदोलन करण्याआधी शास्त्रज्ञांनी वस्तुस्थिती पहावी, असा अनाहूत सल्लाही त्यांनी शास्त्रज्ञांना दिला.

आगारकर संस्थेत शर्मा उपस्थित होते. ते म्हणाले, '२०१४-१५ नंतर विज्ञान-तंत्रज्ञानातील बजेट तिप्पट केले असून, गवे संशोधन प्रकल्पही सुरू करण्यात आले आहेत. उलट तीन वर्षांपूर्वी बजेटमध्ये फारशी वाढ झाली नव्हती.' या वेळी त्यांनी

तयार होणार पोर्टल

'देशात अनेक शैक्षणिक संस्थांत वैज्ञानिक संशोधनासाठी आवश्यक अशी अद्ययावत उपकरणे आणि साधने आहेत. शैक्षणिक कार्यालयांतिरिक्त ही उपकरणे आवश्यकता भासल्यास उद्योग जगतालाही योग्य मोबदल्यावर मर्यादित कालावधीसाठी उपलब्ध व्हावीत, यासाठी केंद्रसरकारच्या विज्ञान-तंत्रज्ञान विभागातर्फे महत्त्वाचे पाउल उचलण्यात येत आहे. त्याअंतर्गत आता एक नेक्सपोर्टल तयार करण्यात येणार असून, त्यावर देशातील विविध शिक्षण संस्थांतील उपलब्ध उपकरणांची तसेच ई-स्रोतांची देखील सविस्तर माहिती टाकण्यात येईल. नव्या संशोधनासाठी हे उपयुक्त ठरेल. संशोधन पुढच्या टप्प्यावर नेण्यात शिक्षण संस्था आणि उद्योग एकत्र यायला हवेत,' असेही शर्मा म्हणाले.

आपले शास्त्रज्ञ गणितात जागतिक पातळीवर पुढे का नाहीत ?... शिअरीमध्ये ते पुढे का नाहीत ? असे प्रश्नही उपस्थित केले.

दरम्यान, ५७ व्या एम. पी. आगारकर स्मृती व्याख्यानात बोलताना शर्मा म्हणाले, 'विज्ञान आणि तंत्रज्ञानाच्या दृष्टीने भविष्यकाळ मोठा रंजक, विलक्षण पडाव्यांचा आणि स्थित्यंतरांचा असणार आहे. गेल्या काळात डिजिटल आणि मायक्रो क्षेत्र एकत्र येत दैनंदिन जगण्याचे अनेक सूत्रे बदलून टाकतील. मानवाच्या जीवनात मोबाइल (बोट्स) त्याचा पार्टनर म्हणून आलेले दिसतील. इंटलिजंट मशिन्स हेच उद्याचे भविष्य असणार आहेत.'

Agrowon, Pune 28.10.2017

प्रक्रिया उद्योगासाठी बन्सी गव्हाच्या सुधारित जाती विकसित

पुणे येथील आगरकर संशोधन संस्थेतील तज्ज्ञांनी बन्सी गव्हाच्या दोन सुधारित जाती विकसित केल्या आहेत. शिरवळी आणि बागायती अशा दोन्ही क्षेत्रांमध्ये लागवडीसाठी स्वतंत्रपणे उपलब्ध असलेल्या जातींचा या नवीन जातीचे उत्पादन सर्वोत्तम असल्याचे सिद्ध झाले आहे. दोन्ही जातींची बेकिंग चेलीसाठी (१५-२० ऑक्टोबर) शिफारस आहे.

एमएसीएस ३९४९ या जातीची वाणगावी येथे झालेल्या अखिल भारतीय गहू व सातू संशोधकांच्या परिषदेत लागवडीसाठी शिफारस करण्यात आली. एमएसीएस ४०२८ ही जात पुढील वर्षी (२०१८ -१९) शिफारसीत होईल, अशी माहिती डॉ. बी. के. होनराव यांनी दिली. दोन्ही जाती भरपूर पोषकमूल्ययुक्त, अधिक उत्पादनक्षम आहेत. या जाती दर्जेदार रवा, पास्ता, नूडल्स, लाडूनिर्मितीसाठी फायदेशीर आहेत. एमएसीएस ३९४९ ही जात बागायती लागवड आणि एमएसीएस ४०२८ ही जात शिरवळी लागवडीसाठी शिफारस केलेली आहे.

- विकास चाटी

जातींची वैशिष्ट्ये

एमएसीएस ३९४९
- मोठे चमकदार दाणे, हजार दाण्यांचे वजन ४७ ग्रॅम
- तांबेरा रोगाला प्रतिकारक
- पोषकद्रव्यांचे प्रमाण : प्रथिने - १०.६ पीपीएम, लोह - ३८.९ पीपीएम, प्रथिने - १२.९ टक्के
- प्रक्रियेसाठी उत्तम.
- पूर्वहंगामी ४२८ या जातीपेक्षा ५.२६ टक्के अधिक उत्पादन.
- पेरणीसाठी बागायतीसाठी पाच पाण्याच्या पाळ्या द्याव्या लागतात.
- सरासरी उत्पादन (प्रतिहेक्टर) : ४९ क्विंटल, जास्तीत जास्त ६४.३ क्विंटल

एमएसीएस ३९४९

एमएसीएस ४०२८
- शिरवळी लागवडीसाठी योग्य.
- शिरवळी बन्सी जात एकेडीडब्लू - २९९७-१६ व पूर्वहंगामी ४४६ या जातींपेक्षा १९ टक्के जास्त उत्पादनक्षम
- तांबेरा रोगप्रतिकारक.
- मोठ्या चमकदार दाणा, हजार दाण्यांचे वजन ४७ ग्रॅम
- पुटकी जात, ५३ व्या दिवशी फुलोऱ्यात व १०२ दिवसांत तयार होते.
- पोषकमूल्य : जस्त ४०.३ पीपीएम, लोह ४६.१ पीपीएम व प्रथिने १४.७
- प्रक्रियेसाठी उत्तम जात.
- सरासरी उत्पादन(प्रतिहेक्टरी) : १९.३ क्विंटल, जास्तीत जास्त २८.७ क्विंटल

एमएसीएस ४०२८

Times Of India - Pune, 2017

Web portal to book slots in institutes to start in Jan

Pune: An integrated portal will be launched in January where industries can book slots to use infrastructure available in academic and research institutions, revealed Ashutosh Sharma, secretary of the Department of Science and Technology, at the sidelines of a programme held at Agharkar Research Institute on Saturday.

However, when enquired about the lack of funding to fundamental research institutes, thereby forcing them to cut down on equipment and other resources, Sharma denied the allegation and said that funding for fundamental science has doubled in the past five years.

Till two years ago, 150 researchers were waiting to use an electron microscope at National Chemical Laboratory in Pune. Like NCL, premier scientific institutions are buckling under pressure of infrastructure crunch. As a result, resources are being shared by two or more institutions.

A scientist noted that the ratio between researchers and equipment was poor. "We have anywhere between 500 to 1,000 scientists in the city who need transitional-electronic microscope. We have one in NCL and another one, although not of same standard, in Pune University. Hence, we go around requesting for a slot. Sometimes, the slot comes at a price as the host institution may want its name in the list of co-authors."

Sharma said that equipment which value more than Rs 50 lakh would be first mapped and then certain time-slots would be made available for industries through an online portal.

"There is no way to know whether a certain infrastructure in an institution can be used by outsiders or not. A transparent online system will solve the problem," Sharma said.

Satishchandra Ogale, who recently won the Newton Prize and works at IISER, said even if slots are allotted to industries, priority should be given to academia. "We need more advanced machines. We also need a maintenance fund. If the government decides to allot slots to industry, we need to give it at a premium price. The money can be used for maintenance."

'Common sense approach must to address problems'

ST CORRESPONDENT
reporters@sakaaltimes.com

> While stating that science and life are inter-related Ashutosh Sharma while speaking at an event, urged, researchers must look at nature as the greatest teacher.

Pune: A common sense approach is often required to address scientific problems, said Ashutosh Sharma, Secretary of Department of Science and Technology of Government of India while speaking on 'Navigating scientific complexity by common sense' at the 57th Shankar Purushottam Agharkar Memorial Oration at Agharkar Research Institute on Saturday.

"Lateral thinking, creativity or common sense must be put into practice by science researchers to arrive at solutions," said Sharma, citing the example of the great Indian mathematician Ramanjan as an exceptional example of independent thinking.

"Creativity could be achieved through connecting the dots of fragmented knowledge by relating one science to another and by an open book approach," said Sharma.

While stating that science and life are inter-related he urged, researchers must look at nature as the greatest teacher giving examples of the lotus leaf which is a water repellent property that can have a bearing on paint technology, and the reversible adhesion property that can be understood from frogs and insects.

"The last mile connectivity in science and technology will enable researchers to move out of the laboratories and benefit the society," said Sharma.

टोकियोतील विद्यापीठाशी आघारकर संस्थेचा करार

पुणे, ता. ३ : आघारकर संशोधन संस्था आणि टोकियो गाकुगेई विद्यापीठ यांच्यात संशोधन, विकास आणि संबंधित क्षेत्रांमध्ये नुकताच करार करण्यात आला. शेवाळातील 'डायएटम्स' या प्रकाराच्या अभ्यासावर या करारांतर्गत भर दिला आहे,'' असे संस्थेचे संचालक डॉ. किशोर पाकणीकर यांनी सांगितले.

'डायएटम्स'चा उपयोग पाण्याचे प्रदूषण जाणून घेण्यासाठी केला जातो. त्याशिवाय काही विशिष्ट गुन्ह्यांची उकल करण्यासाठीही त्याचा उपयोग होतो, असे संस्थेतील वैज्ञानिक डॉ. कार्थिक चालसुब्रमणियन यांनी नमूद केले. डॉ. कार्थिक यांनी काही नवीन 'डायएटम्स'चा शोध लावला आहे.

डॉ. पाकणीकर म्हणाले, ''वैज्ञानिक आणि विद्यार्थ्यांची देवाणघेवाण, सहयोगात्मक संशोधन, बौद्धिक स्वामित्व हक्क आणि अन्य क्षेत्रांच्या विकासासाठी या कराराचा उपयोग होणार आहे.'' टोकियो गाकुगेई विद्यापीठाचे अध्यक्ष डॉ. तोशिसाडा देगुची आणि डॉ. पाकणीकर यांनी करारावर स्वाक्षऱ्या केल्या. यापूर्वी आघारकर संशोधन संस्थेचा कोरियातील संस्थेबरोबर वनस्पतींच्या रेण्विक वर्गीकरणासंबंधी करार झाला आहे.

'Researchers should put creativity or common sense into practice'

EXPRESS NEWS SERVICE
PUNE, NOVEMBER 19

LATERAL THINKING, creativity or common sense must be put into practice by science researchers to arrive at solutions, said Professor Ashutosh Sharma, secretary, Department of Science and Technology.

Sharma said mathematician Ramanujan was the best example of independent thinking.

Speaking on 'Navigating Scientific Complexity By Common Sense', at the MACS-Agharkar Research Institute on the occasion of the 57th Prof Shankar Purushottam Agharkar Memorial Oration, Sharma called for a common sense approach to address various scientific problems.

"Creativity could be achieved through connecting the dots of fragmented knowledge by relating one science to another and by an open book approach," he said.

He urged researchers to look at nature as the greatest teacher. For example: lotus leaf has a water repellent property that can have a bearing on paint technology, while one can learn about reversible adhesion property from frogs and insects.

Sharma also pointed out that science and life were 'inter-related'. "Proximal areas of science and technology must be explored to survive in a competitive market," he said, citing the example of digital photography.

He said digital photography worked as a disruptive technology and relegates conventional photography.

His lecture was replete with examples of scanning tunneling microscopy, atomic force microscopy, graphene, microstructures on the shark skin as antifouling structures, very thin liquid films, self organisation in natural processes, liquid-oxygen, array of lenses and shrinking of structures.

Sharma explained multidisciplinary studies involving chemical engineering, biology, physics and medical science during the talk. "The last mile connectivity in science and technology will enable research to move out of the laboratories and benefit the society", he said.

On the occasion, the 'Shri VP Gokhale Award' was presented to Dr Rukam Singh Tomar, the Dr RB Ekbote Award was presented to Dr NK Singh and the Dr Pradnya P Kanekar Award was presented to Dr Virendra Gajbhiye.

The Indian EXPRESS epaper editions Mon, 20 November 2017 epaper.indianexpress.com//c/23883097

Institutional Research Projects

Sr. No.	Project Code	Project Title	Investigator(s)	Associated Staff
1	BD02	Palaeozoogeographic provincialism and faunal diversity: Kachchh Paleogene basin	Kulkarni KG	Kamble A
2	BD03	Modernization of fossil repository	Kaushik T Kulkarni KG	Sikilkar N
3	BD04	Studying the diversity and taxonomy of modern foraminifera from coastal Maharashtra using morphological and molecular tools	Kaushik T Dagar SS	Thirumalai M
4	BD05	Screening of fungi for bio-control of powdery mildew of grapes	Singh PN Singh SK Tetali S	Lagashetti A
5	BD07	Diatom Herbarium and Culture Collection	Karthick B	Wadmare N
6	BD01	Unravelling the vascular plant endemism of Northern region of Western Ghats	Datar MN	Shigwan B
7	BD06	Study of neuro-protective potential via antioxidant action and active constituents determination of parmelioid lichens from Western Himalayan Region	Behera BC Baghela A Sharma BO	Gaikwad S Mapari S Khare R
8	BD08	Reappraisal of taxonomy of parmelioid lichens using morphological, molecular tools and phylogenetic analysis	Sharma BO Rajesh Kumar KC	Gaikwad S
9	BE01	Investigating the methane mitigation potential of cultivated metanotrophs isolated from rice fields for application as bioinoculants	Rahalkar M Kshirsagar P	
10	BE02	Biomethanation from rice straw using inoculum supplemented with anaerobic fungi: Scale up	Kshirsagar P Dhakephalkar PK Dagar SS	
11	BIO24	Natural supplements for the treatment of inflammation associated anemia	Kulkarni PP	Ghatpande N Misar A
12	BOT15	Digitizing Herbarium - AHMA	Datar MN	Gaikwad N Kulkarni A
13	BOT17	Repository of crude drugs, authentication service and development of HPTLC profile library of phytochemical reference standards	Upadhye AS	Rakshe A
14	BOT21	Developing profiles for medicinally important species from Genus *Solanum* L. and their application in identification of market samples	Upadhye AS Tamhankar SA Choudhary RK	Joshi R
15	BOT22	Molecular phylogeny of *Eriocaulon* L. of the Northern Western Ghats, India	Choudhary RK Tamhankar SA Datar MN	Darshetkar A
16	BOT23	Do semi-aquatic habitats act as refugia for endemic diatoms in Western Ghats and Eastern Ghats?	Karthick B	Lokhande V

Sr. No.	Project Code	Project Title	Investigator(s)	Associated Staff
17	DB01	Role of VEGF and FGF signaling in regeneration and pattern formation in hydra	Patwardhan V Ghaskadbi SM	-
18	DB02	Characterization of Dmon1 expression in the embryonic CNS in *Drosophila*	Ratnaparkhi A	-
19	GEN16	Mapping QTL/genes for resistance to spot blotch caused by *Bipolaris sorokiniana* in durum wheat	Tamhankar SA Patil RM Honrao BK	Venkatesan S
20	GEN17	Mitigating the drought stress through agronomical, physiological and molecular breeding tools in soybean	Jaybhay SA Patil RM Varghese P	Mundhe S
21	GEO17	Role of ichnofauna in deciphering sequence of deposition of the Upper Jurassic rocks of the Marwar Basin	Kulkarni KG	Salunkhe S
22	MYC02	National Facility – repositories and service (NFCCI, AMH, and identification service)	Singh SK Singh PN Rajeshkumar KC Baghela A	Maurya D Lad S
23	MYC08	Taxonomy, multigene phylogeny and monographic documentation of Indian Fusaria	Singh SK Baghela A	Rana S
24	MYC09	Development of multi-locus microsatellite typing (MLST) method and an efficient gene targeting system for a devastating plant fungal pathogen *Colletotrichum gloeosporioides*	Baghela A Singh SK	Mehta N
25	NBS07	Modification of Lanthanum Strontium Manganese Oxide (LSMO) nanoparticles for active targeting; and assessment of tumor regression in a rodent model of breast cancer	Umrani R Gajbhiye V Paknikar KM	
26	NBS08	Development of Multitalented Nano-Platform for Targeted siRNA Delivery to LHRH Overexpressed Cancerous cells	Gajbhiye V Paknikar KM	
27	NBS09	Study of chitosan sponge/hydrogel incorporating polymeric nanoparticles with blood clotting factors for improved hemostasis	Ghormade V	
28	VIRO01	Study of Salmonella bacteriophages from environment	Banerjee K Karpe Y	
29	ZOO17	Molecular investigations of autophagic process during starvation, tissue regeneration and protein aggregate clearance	Shravage BV Kulkarni PP Ghaskadbi SM	Bali A
30	ZOO18	Identification and functional analysis of novel regulators during heart development and regeneration	Patra C	Bhujbal S

Sponsored Projects

No.	Code	Project	Sponsor	PI, Co-PI
1	ARI/SP/001	All India Co-ordinated Research Project on Soybean (1.4.1968 onwards)	ICAR, New Delhi	P Varghese
2	ARI/SP/002	All India Co-ordinated Fruit Improvement Project (1.10.70 onwards)	ICAR, New Delhi	SP Tetali
3	ARI/SP/003	All India Co-ordinated Wheat Improvement Project (1.4.1972 onwards)	ICAR, New Delhi	BK Honrao
4	ARI/SP/033	Production of Soybean Breeder Seeds of Annual Oil Seed Crops (2.2.88 onwards)	ICAR, New Delhi	P Varghese
5	ARI/SP/034	Front-line Demonstrations of Annual Oil Seed Soybean (21.2.89 onwards)	ICAR, New Delhi	P Varghese
6	ARI/SP/043	Front-line Demonstrations in Wheat (1.4.1993 onwards)	ICAR, New Delhi	BK Honrao
7	ARI/SP/096	Wheat Breeder Seed Scheme (1995 Onwards)	ICAR, New Delhi	BK Honrao
8	ARI/SP/118-(A)	CRP Agrobiodiversity Project (1.4.2014 onwards)	ICAR, Karnal	BK Honrao
9	ARI/SP/168	Digitized Inventory of Medicinal plant resources of Maharashtra (Extended up to 30.9.2017)	RGSTC, Mumbai	AS Upadhye
10	ARI/SP/183	Indo-Australian project on root and establishment traits for greater water use efficiency in wheat (23.11.2009-23.11.2017)	ICAR, Karnal	BK Honrao
11	ARI/SP/211	Enhancing use efficiency of micronutrients: Novel delivery systems (28.6.2012-19.6.2017)	ICAR, New Delhi	KM Paknikar
12	ARI/SP/218	Exploitation of inter-specific biodiversity for wheat improvement (1.3.2013-30.6.2018)	DBT, New Delhi	BK Honrao
13	ARI/SP/224	Microbial control of methane turnover in rice fields (19.7.2013-23.5.17)	DBT, New Delhi	MC Rahalkar PK Dhakephalkar
14	ARI/SP/226	Late Holocene vegetation, climate dynamics and human – environment iteraction along Konkan coast, India (2.7.2014-1.7.2017)	DST, New Delhi	R Limaye
15	ARI/SP/227	Chikungunya virus replication and ubiquitin system (1.1.2014-14.6.2017)	DST, New Delhi	YA Karpe
16	ARI/SP/228	Cell-penetrating peptides as drug delivery agents for cancer & Alzheimer (16.5.2014-15.5.2019)	DST, New Delhi	A Jha

No.	Code	Project	Sponsor	PI, Co-PI
17	ARI/SP/229	Engineered nanocancer mediated targeted co-delivery of siRNA & anti-cancer drugs for effective gene silencing & tumor therapy (1.7.2014-30.6.2019)	DST, New Delhi	V Gajbhiye
18	ARI/SP/230	Development of microfluidics immunoassay for detection of salmonella typhimurium (25.7.2014-24.1.2018)	DST, New Delhi	DS Bodas KM Paknikar
19	ARI/SP/231	Development of Crude Drug Repository of Genuine samples from Maharashtra (16.8.14-15.8.2019)	RGSTC, Mumbai	AS Upadhye
20	ARI/SP/232	Safe healthy food farm to table: new diagnostic tools for detection mycotoxin procedures, mycotoxin and food borne microbial pathogen (10.10.2014-9.10.2018)	DBT, New Delhi	V Ghormade
21	ARI/SP/234	Development of field level nanoparticles based immunodiagnostics for viral pathogens of shrimp and prawn (27.1.2015-14.2.2019)	DBT, New Delhi	KM Paknikar
22	ARI/SP/235	Isolation of hyperthermophiles for MEOR application for reservoirs above 90 deg C (10.2.2015-9.6.2017)	ONGC, Ahmedabad	PK Dhakephalkar MC Rahalkar
23	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) (26.3.2015-25.3.2020)	DBT, New Delhi	MD Oak
24	ARI/SP/239	Identification and analysis of extracellular matrix components important for heart development using zebrafish as model organism (12.3.2015-11.3.2020)	Max Planck, Germany & DST, New Delhi	C Patra
25	ARI/SP/240	An integrated approach of molecular breeding for downy powdery mildew resistance in grape (21.5.2015-19.8.2018)	DBT, New Delhi	SP Tetali
26	ARI/SP/242	Dark energy microbial biosphere in ocean sediments: geomicrobial & astrobiological implications (7.7.2015-6.7.2018)	SERB, New Delhi	A Das
27	ARI/SP/244	Impact of EMF radiation on animal development at cellular & molecular levels (30.6.2015-29.6.2018)	SERB, New Delhi	A Ratnaparkhi
28	ARI/SP/245	Novel indole derivatives and their metal complexes for Alzheimer's disease (18.9.2015-17.9.2018)	SERB, New Delhi	PP Kulkarni

No.	Code	Project	Sponsor	PI, Co-PI
29	ARI/SP/246	Isolation and characterlzatlon of SRB lysing bacteriophage for inhibition of petroleum field souring and SRB induced corrosion (23.9.2015-23.9.2017)	OECT, New Delhi	PK Dhakephalkar SS Dagar
30	ARI/SP/247	Identification and characterization of kinetochore proteins of a devastating plant fungal pathogen *Collectrichum graminicola* and their application in characterizing the centromeres in a genome-wide analysis (16.11.2015-15.11.2018)	SERB, New Delhi	A Baghela
31	ARI/SP/248	Studies on the biodiversity and bioactivity assessment of high altitudinal lichens having economic potential in Western Himalaya (21.11.2015-20.11.2018)	SERB, New Delhi	R Khare
32	ARI/SP/249	Exploring the diversity of lignocellulose degrading thermophilic anaerobic bacteria from Indian hot springs for bioenergy applications (26.11.2015-25.11.2018)	SERB, New Delhi	SS Dagar
33	ARI/SP/250	Marker assisted elimination of off-flavour generating lipoxygenase-2 gene from kunitz trypsin inhibitor free soybean genotypes (4.12.2015-3.12.2020)	DBT, New Delhi	P Varghese MD Oak
34	ARI/SP/251	Identification of enhancers regulating expression in glial subsets in *Drosophila* (15.2.2016-14.2.2019)	DST, New Delhi	A Ratnaparkhi
35	ARI/SP/252	Can diatom communities across spatial and environmental gardients of Western Ghats reflect water quality conditions of streams? (26.2.2016-25.2.2019)	SERB, New Delhi	Karthick B
36	ARI/SP/253	Polyphasic taxonomy, conservation and monographic documentation of Indian *Aspergillus* and *Penicillium* species (9.3.2016-8.3.2019)	SERB, New Delhi	Rajeshkumar KC
37	ARI/SP/254	Elucidating the community structure of methanogenic archaea in methane hydrates (29.3.2016-28.3.2019)	SERB, New Delhi	VB Lanjekar
38	ARI/SP/255	Studies on nanoparticles assisted dispersion of biofilms formed in drinking water distribution system (31.3.2016-30.3.2018)	DST, New Delhi	JM Rajwade
39	ARI/SP/256	Investigating the role of autophagy in stem cell maintenance and ageing (25.5.2016-24.5.2021)	DBT, New Delhi	BV Shravage

No.	Code	Project	Sponsor	PI, Co-PI
40	ARI/SP/257	Active micromixer mediated controlled synthesis of polymeric nanoparticles, *in situ* drug loading and their effect on fungal cells (30.9.2016-29.9.2019)	SERB, New Delhi	DS Bodas KM Paknikar V Ghormade
41	ARI/SP/258	Biomethanation under simulated Mars environment implies early life on planet Mars (1.9.2016-30.9.2019)	ISRO, Bangalore	A Das
42	ARI/SP/259	Deciphering the role of adhesion G protein-coupled receptors during heart developing using zebrafish as a model oraganism (22.9.2016-21.9.2019)	SERB, New Delhi	C Patra
43	ARI/SP/260	Determining the role of autophagy in germline stem cell ageing in Drosophila (21.9.2016-20.9.2019)	SERB, New Delhi	BV Shravage
44	ARI/SP/261	Delivery of miRNA-nanoparicle complex to promote cardiac repair and regeneration after myocardial injury (26.12.2016-25.12.2019)	DST, New Delhi	V Gajbhiye
45	ARI/SP/262	Understanding the morphological evolution and ecological diversification of the forest dwelling Capers in Indian subcontinent using molecular phylogenetic tools (3.11.2016-3.11.2019)	SERB, New Delhi	RK Choudhary SA Tamhankar MN Datar
46	ARI/SP/263	Candidate Chikungunya virus vaccine: Nanoparticle mediated delivery of recombinant antigen presenting cells (1.4.17-31.3.2020)	SERB, New Delhi	YA Karpe V Gajbhiye KM Paknikar
47	ARI/SP/264	Development of TILLING resource in Indian durum wheat Bijaga Yellow for forward- and reverse-genetics analysis (17.3.2017-18.3.2020)	SERB, New Delhi	RM Patil SA Tamhankar MD Oak
48	ARI/SP/265	Muraina-grasses of India: addressing the polymorphism and interspecific variations through morphological, ecological and molecular phylogenetic studies (23.3.2017-22.3.2020)	SERB, New Delhi	MN Datar RK Choudhary SA Tamhankar
49	ARI/SP/266	Deciphering the past environmental conditions of freshwater myristica swamps of Western Ghats using diatom assemblages (18.4.17-17.4.2020)	Ministry of Earth Sciences	Karthick B
50	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 (27.3.2017-26.3.2020)	DST, New Delhi	V Ghormade

No.	Code	Project	Sponsor	PI, Co-PI
51	ARI/SP/268	Conservation of selected endemic species of orchids of Northern Western Ghats through ex situ multiplication and reintroduction in wild (8.5.17-7.8.2020)	TATA Power Corporation	MN Datar AS Upadhye
52	ARI/SP/269	Scale-up synthesis of *Jasada bhasma* inspired zinc oxide, development of formulation(s) thereof, and validation of their biological activity (1.6.17-31.5.2018)	In collaboration with Pitambari	RD Umrani KM Paknikar
53	ARI/SP/270	Exploring non-pathogenic protozoa as a eukaryotic platform for protein expression (15.6.17-14.6.2020)	DBT, New Delhi	YA Karpe K Kondabagil
54	ARI/SP/271	Study of role of Untranslated Regions (UTR) in the genome of Chikungunya virus (1.6.2017-31.5.2020)	CSIR, New Delhi	YA Karpe
55	ARI/SP/272	Ichnological and sedimentological evaluation of the Chhasra formation (Burdigalian), Kachchh, Gujarat (26.7.2017-25.7.2020)	CSIR, New Delhi	KG Kulkarni
56	ARI/SP/273	Evaluation of in vitro biocompatibility of photofunctionalized dental implant materials (Extended up to 3.3.2019)	DY Patil, Pimpri	JM Rajwade
57	ARI/SP/274	Diatom and cyanobacteria flora of Peninsular India: molecular reinvestigation of endemic and cosmopolitan taxa across biodiversity hotspot (Western Ghats) (16.8.2017-16.8.2019)	DST, New Delhi	Karthick B
58	ARI/SP/275	Metagenomics aided augmentation of resident microbes and their metabolism to enhance oil recovery from depleted reservoirs (27.7.2017-26.7.2020)	DBT, New Delhi	A Engineer
59	ARI/SP/276	Elucidating the potential of anaerobic rumen fungi for enhancing biomethanation in anaerobic digesters fed on agricultural wastes (29.11.2017-28.11.2020)	DBT, New Delhi	SS Dagar PK Dhakephalkar
60	ARI/SP/277	Development and demonstration of bioconversion process for generation of methane from subsurface lignite deposits (9.1.2018-8.1.2020)	OECT, New Delhi	PK Dhakephalkar SS Dagar
61	ARI/SP/278	Determining the role of autophagy in germline stem cell maintenance (31.1.2018-31.1.2021)	DBT, New Delhi	BV Shravage VG Patwardhan SM Ghaskadbi
62	ARI/SP/279	Freshwater diversity of Peninsular India (excluding Tamil Nadu): Taxonomic enumeration and development of online flora (18.1.2018-19.1.2021)	MoEFCC, New Delhi	Karthick B

No.	Code	Project	Sponsor	PI, Co-PI
63	ARI/SP/280	Role of Dmon 1 at the synapse and regulation of glutamate receptors (21.3.2018-20.3.2021)	DBT, New Delhi	A Ratnaparkhi
64	ARI/SP/281	Pyramiding of rust resistance genes into high grain quality wheat lines developed through marker-assisted selection (19.3.2018-18.3.2021)	DBT, New Delhi	SA Tamhankar MD Oak RM Patil
65	ARI/SP/282	Bioresource and sustainable livelihoods in North-East India (29.3.2018-28.3.2021)	DBT, New Delhi	Karthick B A Baghela
66	-----	Role of BMP signaling inhibitors Noggin and gremlin in pattern formation in hydra) (2.5.2016-1.5.2019)	CSIR, New Delhi	SM Ghaskadbi

Personnel (List of Staff Members as of 31.03.2018)

Director (Officiating)

Dr KM Paknikar, Sc. G

Biodiversity & Paleobiology Group

Biodiversity - Fungi

Dr SK Singh, Sc. E
Dr PN Singh, Sc. C
Dr Rajesh Kumar KC, Sc. C
Dr A Baghela, Sc. C
SB Gaikwad, Technical Assistant B
DK Mourya, Lab. Assistant C
SS Lad, Lab. Assistant C

Biodiversity - Lichens

Dr BC Behera, Sc. E
Dr BO Sharma, Technical Officer B

Biodiversity - Palaeobiology

Dr KG Kulkarni, Sc. D
Dr T Kaushik, Sc. B
Dr PG Gamre, Technical Officer A
SS Deshmukh, Lab. Assistant E
MD Chavan, Attendant D

Biodiversity – Plants

Dr RK Chaudhary, Sc. D
Dr Karthick B, Sc. D
Dr MN Datar, Sc. C
VN Joshi, Technical Assistant B
MH Mhetre, Lab. Assistant D
NS Gaikwad, Lab. Assistant C
SA Pardhi, Lab. Assistant A

Biodiversity – Garden

Dr AS Upadhye, Sc. C
KH Sable, Technical Officer A
SN Gajbhar, Attendant D
MT Gurav, Attendant C

Bioenergy Group

Dr PK Dhakephalkar, Sc. F
Dr MC Rahalkar, Sc. D
Dr SS Dagar, Sc. C
PR Kshirsagar, Sc. C
Dr DC Kshirsagar, Technical Officer C
AS Kelkar, Technical Officer B
Dr VB Lanjekar, Technical Officer B

Bioprospecting Group

Dr PP Kulkarni, Sc. E
Dr P Srivastava, Sc. C
Dr HM Puntambekar, Technical Officer C
Dr RJ Waghole, Technical Assistant B
Dr AV Misar, Technical Assistant B

Developmental Biology Group

Dr SM Ghaskadbi, CSIR Emeritus Scientist
Dr A Ratnaparkhi, Sc. E
Dr C Patra, Sc. C
Dr BV Shravage, Sc. C
MB Daware, Technical Officer B
RJ Londhe, Technical Officer A
AA Nikam, Lab. Assistant

Genetics & Plant Breeding Group

Dr SC Misra, ARI Emeritus Scientist
Dr SA Tamhankar, Sc. F
Dr BK Honrao, Sc. F
Dr MD Oak, Sc. D
Dr P Varghese, Sc. D

Dr SP Tetali, Sc. C
Dr RM Patil, Sc. C
SA Jaybhay, Sc. C
AM Chavan, Sc. B
Y Kumar, Sc. B
Dr VS Baviskar, Sc. B
VM Khade, Technical Officer B
SP Karkamkar, Technical Officer B
VD Surve, Technical Officer B
JH Bagwan, Technical Officer A
BD Idhol, Technical Officer A
SV Phalake, Technical Assistant B
BN Waghmare, Technical Assistant B
VD Gite, Technical Assistant B
SS Khairnar, Technical Assistant B
AA Deshpande, Technical Assistant B
JS Sarode, Lab. Assistant C
SS Raskar, Technical Assistant A
DH Salunkhe, Lab. Assistant C
DN Bankar, Lab. Assistant B
PG Lavand, Technician A
SL Bhandalkar, Attendant B
SR Kachhi, Attendant A
SV Ghadge, Attendant A
DL Kolte, Attendant A
TB Dhurve, Attendant A
GS Rajguru, Attendant A

Nanobioscience Group

Dr KM Paknikar, Sc. G
Dr JM Rajwade, Sc. E
Dr DS Bodas, Sc. D
Dr V Ghormade, Sc. D
Dr RD Umrani, Sc. D
Dr V Gajbhiye, Sc. D
Dr YA Karpe, Sc. C
RG Bambe, Technical Assistant B
A Dwivedi, Technical Assistant A
SS Waghmare, Lab. Assistant C
Nayankumara D, Technician A

Animal House

Dr JM Rajwade, Sc. E
Dr SH Jadhav, Sc. C
KV Tiwari, Attendant A
VM Gosavi, Attendant A

Director's Office

Dr GK Wagh, Technical Officer D
Dr PP Apte, Technician B
RS Shinde, Assistant A
SP Balsane, Attendant A

Administration Unit

A Rahman, Administrative Officer
VB Bhalerao, Officer B
CD Nagpure, Officer A
AG Dhongade, Sr. Pvt. Secretary
JV Deshpande, Pvt. Secretary
DS Zade, Assistant B
MB Tiwari, Assistant B
MV Patake, Assistant A
PD Gagare, Assistant A
RM Dhandhore, Attendant B
AB Kusalkar, Driver
GH Agawan, Driver

Accounts Unit

SA Ashtaputre, Finance & Accounts Officer
HN Mate, 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

Purchase Unit

PV Gosavi, Stores & Purchase Officer
SA Tembe, Officer B
US Kulkarnii, Officer A
SS Kalekar, Assistant A
DV Gavade, Assistant A
SS Chavan, Assistant A
AT Salvi, Attendant B

Store Unit

VG Tallu, Officer A
RB Dhobale, Assistant A
SA Shaikh, Assistant A
PA Tembe, Assistant A
RM Salunke, Attendant C

Engineering Unit

AV Chaudhari, Technical Officer D
M Kharade, Technical Officer C
PV Sawant, Technical Officer A
RG Murade, Technician A
DS Shinde, Technician A
SB Karanjekar, Attendant D

Library & Information Center

Dr SN Kulkarni, Pr. Lib. & Info. Officer
RP Janrao, Asst. Lib. & Info. Officer
SA Deshmukh, Sr. Lib. Assistant
AD Patil, Assistant B
RR Kale, Library & Info. Assistant

Other Technical Staff

Shri BA Kawthekar, Technician D

Promotions

Scientific Staff

Dr PP Kulkarni, Sc. E
Dr BK Honrao, Sc. F
Dr P Varghese, Sc. D
Dr RK Chaudhary, Sc. D
Dr Karthick B, Sc. D
Dr MC Rahalkar, Sc. D
Dr RD Umrani, Sc. D
Dr V Gajbhiye, Sc. D
Mr SA Jaybhay, Sc. C

Appointments

Sr. No.	Name & Designation	Group/ Unit	Date of Joining
Technical			
1	Mr VB Lanjekar	Bioenergy	1.9.2017
Ministerial			
1	Mr A Rahman	Administration	11.5.2017
2	Mr RR Kale	Library	20.2.2018

Superannuation

G Barik, Administrative Officer, 30.4.2017

PP Pathak, Officer B, 30.11.2017

AD Sonvalkar, Driver (Special Grade), 30.6.2017

TA Kolte, Attendant D, 31.1.2018

Voluntary Retirement

Dr VG Patwardhan, Sc. E, 30.11.2017

NS Mane, Attendant B, 4.9.2017

Resigned

Boni Haldar, Technical Assistant A, 15.12.2017

Deceased while in Service

RK Dongre, Technical Officer D, 24.11.2017

Reservation & Concessions

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.

Details of posts filled during 2017-2018

Group	SC	ST	OBC	General	Total
A	-	-	-	1	1
B	--	--	1	-	1
C	-	--	--	1	1
Total	0	0	1	2	3

Research Fellows

Research Associates

Dr Gauri Katre

Dr Gauri Mirji

Dr Anupama Engineer

Dr Pradnya Kedari

Senior Research Fellows

Sponsored Projects

Azhar Shaikh

Junior Research Fellows

ARI Projects

Aboli S Kulkarni

Neha Wadmare

Thirumalai M

Sachin Mapari

Payal Deshpande

Saurabh Gaikwad

Sumithra Yasaswini S

Sponsored Projects

Mittal Thacker

Satishkumar Maurya

Snigdha Tiwari

Sai Hivarkar

Akshay Joshi

Henry Kolge

Mitali Naik

Sagar Narlawar

Kiran Nilangekar

Debanjan Mukharjee

Deepak Thombre

Komal Timane

Suhasini Venkatesan

Research Students

ARI Projects

Vini Lokhande

Abhijeet Rakshe

Bhushan Shigwan
Sohan Salunkhe
Namra Sikilkar

Sponsored Projects

Sushen B Lomte
Girish P Pathak
Lourelle Dias
Radhakrishnan Cheran
Sarang Bokil
Nikhil Ashtekar
Pooja Mehta
Chaitali Pawase
Nida Sayed
Niketa Chauhan

Parvatibai Agharkar Fellowship

Sulaxna Pandey

Project Assitant

ARI Projects

Shradhha Bhujbal

Sponsored Projects

Kunal Yadav
Shivaji A Parvate

Fellows with Own Fellowship

Soham Pore	CSIR-SRF
Neelam G Kapse	CSIR-SRF
Anagha Basargekar	CSIR-SRF
Mokshada Verma	CSIR-SRF
Gokul D Patil	CSIR-JRF
Smrithy Vijayan	CSIR-JRF
Prajakta Tambe	CSIR-JRF
Kunal D Pingale	CSIR-JRF
Sweta Mallik	CSIR-JRF
Kumal Khatri	CSIR-JRF
Nidhi Nirola	CSIR-JRF
Bhagyashri Joshi	CSIR-JRF
Rameshwar Avchar	CSIR-JRF
Ajay Lagashetty	CSIR-JRF
Nikita Mehta	CSIR-JRF
Pooja Salunke	CSIR-JRF
Snehal Jamalpure	CSIR-JRF
Pravinkumar Methe	CSIR-JRF
Ganesh Wagh	CSIR-JRF
Pramod Kumar	DBT-JRF
Ameya Rayrikar	DBT-JRF
Parimal Vikhe	DBT–JRF
Dr Roshni Khare	SERB Young Scientist
Dr Anindita Das	SERB Young Scientist
Dr Anjali Jha	DST Inspire Scientist
Sonali Mundhe	DST–Inspire JRF
Shraddha Rahi	DST–Inspire JRF
Aishwarya Padhye	DST–Inspire JRF
Neha Kulkarni	ICMR JRF
Nishikant Dixit	ICMR SRF
Komal Raval	UGC-JRF
Bhushan Khairnar	UGC-JRF
Rajashree Patil	UGC-JRF
Vaibhav Madiwal	UGC-JRF
Sneha Tapdia (Maheshwari)	UGC-JRF
Pradnya D Nagkirti	UGC-JRF
Kasturi Shrish Deore	UGC-JRF
Shivali Rana	UGC-JRF
Rajesh Salve	UGC-JRF
Alan Thomas	UGC-JRF

Audit Report 2017-18

Maharashtra Association for the Cultivation of Science

Auditors Report

We have audited the attached Balance sheet of Maharashtra Association for the Cultivation of Science, Pune as at 31st March, 2018 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 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 statements presentation & reporting. We believe that our Audit provides reasonable basis of 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 31" March 2018
   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 P M Patankar & Associates
Chartered Accountants
FRN :123794W

Sd/-
Prasad M Patankar
Partner
MRN : 113832

Place: Pune
Date: 27/8/2018

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, 2018

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 manageror 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 P M Patankar & Associates
Chartered Accountants
FRN :123794W

Sd/-
Prasad M Patankar
Partner
MRN : 113832

Place: Pune
Date: 27/8/2018

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

Balance Sheet as on 31.3.2018

Amount - Rs.

FUNDS AND LIABILITIES	SCH.	CURRENT YEAR	PREVIOUS YEAR
CAPITAL ACCOUNTS	A	1,07,61,721	1,07,61,721
CURRENT LIABILITIES	B	24,90,835	17,02,921
INCOME & EXP.A/C (Sub Schedule 4)		1,62,34,896	1,54,70,014
TOTAL		**2,94,87,452**	**2,79,34,656**
PROPERTY AND ASSETS			
FIXED ASSETS	C	93,97,640	95,36,047
INVESTMENTS	D	1,53,42,699	1,41,50,243
DEPOSITS & ADVANCES	E	29,69,132	24,85,251
CASH & BANK BALANCES	F	17,77,981	17,63,115
TOTAL		**2,94,87,452**	**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 P M Patankar & Associates
Chartered Accountants
FRN :123794W

Sd/-
Prasad M Patankar
Partner
MRN : 113832

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: 27/8/2018

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

Income and Expenditure Account for the Year Ended on 31.3.2018

Amount - Rs.

EXPENDITURE	CURRENT YEAR	PREVIOUS YEAR	INCOME	CURRENT YEAR	PREVIOUS YEAR
Depreciation : Immovable Properties (By way of provision or adjustment)	2,965	2,965	Interest (Realised)		
			On S.B. A/c	2,00,054	1,21,509
			On Investments	14,94,501	9,52,809
Establishment Expenses (As per Schedule H)	6,92,407	1,08,726	Donation	2,04,800	3,27,500
Audit fees	3,540	3,450	Income from other Sources (As per Schedule L)	1,93,775	1,75,000
Legal Fees	41,000	1,32,000	Income tax refund received	58,601	4,12,150
Professional fees	59,260	86,210	Life Membership Fees	-	500
Depreciation : Furniture & Dead Stock	1,35,442	46,149			
Expenditure on the object of The Trust (As per Schedule I)	4,52,235	1,25,663			
Surplus carried over to Balane sheet	7,64,882	14,84,305			
TOTAL	**21,51,731**	**19,89,468**	**TOTAL**	**21,51,731**	**19,89,468**

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

As per our report of even date
For P M Patankar & Associates
Chartered Accountants
FRN :123794W

Sd/-
Prasad M Patankar
Partner
MRN : 113832

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: 27/8/2018

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

Statement of Receipts & Payments for the Year Ended on 31.3.2018

Amount - Rs.

RECEIPTS	SCH.	CURRENT YEAR	PREVIOUS YEAR	PAYMENTS	SCH.	CURRENT YEAR	PREVIOUS YEAR
Opening Balances	F	17,63,115	9,84,877	Establishment Expenses	H	3,81,418	1,08,726
Interest Received				Expenditure on Object of Trust	K	3,71,818	1,25,663
On Savings Bank A/c		2,00,054	1,21,509				
Interest on Investments		4,08,259	4,51,433	Audit Fees & Creditors		3,540	3,450
Encashment of FDR with Bank *		-	1,38,85,548	Legal Fees		18,900	1,32,000
Income tax refund received with interest		5,46,980	4,12,150	Professional fees		8,000	86,210
Donation Received				Fixed Deposit with Banks *		-	1,41,48,418
Dr. R.B. Ekbote Award		34,400	27,500				
Dr. Kalyan Banerjee		1,25,000	3,00,000	Indirect Receipt & Payment	J	21,43,77,780	20,51,45,066
Income from Other Sources	G	1,93,775	1,75,000	Closing Balances	F	17,77,981	17,63,115
Indirect Receipt & Payment	J	21,36,67,853	20,51,54,631				
TOTAL		**21,69,39,437**	**22,15,12,649**	**TOTAL**		**21,69,39,437**	**22,15,12,648**

* Encashment of FDR with bank & Fixed Deposit with Bank is shown in Schedule "D" Investments of Balance Sheet

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

As per our report of even date
For P M Patankar & Associates
Chartered Accountants
FRN :123794W

Sd/-
Prasad M Patankar
Partner
MRN : 113832

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: 27/8/2018

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

Schedules to and forming part of Balance sheet as on 31.03.2018

Schedule "A" : Capital Account

Amount - Rs.

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

Schedule "B" : Current Liabilities

Amount - Rs.

PARTICULARS	SUB-SCH	CURRENT YEAR	PREVIOUS YEAR
OTHER LIABILITIES	3	24,90,835	17,02,921
TOTAL(RS.)		**24,90,835**	**17,02,921**

Schedule "C" : Fixed Assets

Amount - Rs.

PARTICULARS	SUB-SCH	CURRENT YEAR	PREVIOUS YEAR
IMMOVABLE PROPERTIES	5	91,35,372	91,38,337
FURNITURE AND DEAD STOCK	6	2,62,268	3,97,710
TOTAL(RS.)		**93,97,640**	**95,36,047**

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

Schedules to and forming part of Balance Sheet as on 31.3.2018

Schedule "D" : Investments

Amount - Rs.

Sr. No.	Name of the Company	Particulars	Date of Investment	Date of maturity	Current Year	Previous Year
	SHARES				1,325	1,325
1	Central Potteries Ltd.	Share of Rs. 25 each				
	Nagpur	Certificate No.1343 bearing Sr.No.29114 to 29126 13 ordinary	21.01.1949			
		Certificate No. 551 bearing Sr.No. 3717 to 3756 40 ordinary	10.06.1940			
2	HINDUSTAN MOTORS LTD.	Shares of Rs. 10 each 50 ordinary	-	-	500	500
		Share certificate No.33932				
		bearing Sr. No.4632651-4632700				
	FIXED DEPOSITS					
1	BANK OF MAHARASHTRA	60088467793	30.12.2017	30.12.2020	3,00,000	3,00,000
		60088467534	30.12.2017	30.12.2020	3,00,000	3,00,000
		60126451909	01.03.2018	01.03.2019	2,00,000	2,00,000
		60152059714	08.11.2017	08.11.2019	16,60,000	16,60,000
		60150708401	23.10.2017	23.10.2019	8,00,000	8,00,000
		60161620207	06.02.2018	06.02.2020	4,00,000	4,00,000
		60137302953	05.07.2017	05.07.2019	17,88,432	15,36,499
		60137302238	05.07.2017	05.07.2019	38,52,010	33,09,383
2	INDIAN BANK	6019228988	05.03.2018	03.03.2021	8,57,788	6,62,122
		6019228671	05.03.2018	03.03.2021	8,57,788	6,62,122
		6056528884	06.08.2015	03.08.2018	2,00,000	2,00,000
		6201547509	24.02.2018	24.02.2019	10,00,000	10,00,000
		6201547485	24.02.2018	24.02.2019	5,00,000	5,00,000
		6201547532	24.02.2018	24.02.2019	10,00,000	10,00,000
3	BANK OF BARODA	249183	02.03.2018	02.03.2019	97,908	91,344
4	BANK OF INDIA	50345110007246	24.11.2017	24.11.2018	15,26,948	15,26,948
	GRAND TOTAL				**1,53,42,699**	**1,41,50,243**

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

Schedules to and forming part of Balance sheet as on 31.3.2018

Schedule "E" : Deposits & Advances

Amount - Rs.

PARTICULARS	CURRENT YEAR		PREVIOUS YEAR	
DEPOSITS :				
Telephone Deposit	14,207		14,207	
Deposit with Court	15,000	29,207	15,000	29,207
ADVANCES :				
Income Tax Deducted at Source	23,62,333	23,62,333	17,41,094	17,41,094
Interest accrued on Investments (Subject to confirmation from bank & other agencies)				
As per last Balance Sheet	7,14,950		3,19,408	
Less Realised during the year	5,29,388		1,33,846	
	1,85,562		1,85,562	
Accrued Interest during the year	3,92,030	5,77,592	5,29,388	7,14,950
TOTAL Rs.		**29,69,132**		**24,85,251**

Schedule "F" : Cash & Bank Balances

Amount - Rs.

PARTICULARS	CURRENT YEAR		PREVIOUS YEAR	
	OPENING BALANCE	CLOSING BALANCE	OPENING BALANCE	CLOSING BALANCE
CASH IN HAND	13,038	35,344	36,275	13,038
BANK :-				
With Bank of Maharashtra Erandwana Branch in Savings A/c No.9709	16,24,444	16,88,994	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	1,25,633	53,643	64,209	1,25,633
TOTAL (RS.)	**17,63,115**	**17,77,981**	**9,84,877**	**17,63,115**

* State Bank of India Deccan Branch A/c No. 01100005452 closed during F.Y 2016-17

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 31.3.2018

Schedule "G" : Income From Other Sources

Amount - Rs.

PARTICULARS	CURRENT YEAR		PREVIOUS YEAR	
	INCOME & EXP. ACCOUNT	RECEIPT & PAYMENT ACCOUNT	INCOME & EXP. ACCOUNT	RECEIPT & PAYMENT ACCOUNT
Sale of Publication	1,775	1,775	-	-
Fee for Home Gardening Course	1,92,000	1,92,000	1,75,000	1,75,000
TOTAL (RS.)	**1,93,775**	**1,93,775**	**1,75,000**	**1,75,000**

Schedule "H" : Establishment Expenses

Amount - Rs.

PARTICULARS	CURRENT YEAR		PREVIOUS YEAR	
	INCOME & EXP. ACCOUNT	RECEIPT & PAYMENT ACCOUNT	INCOME & EXP. ACCOUNT	RECEIPT & PAYMENT ACCOUNT
Honorarium to Staff	1,40,173	1,40,173	70,664	70,664
Meeting Expenses	6,000	6,000	14,909	14,909
Miscellaneous Expenses *	2,03,154	24,420	1,216	1,216
Postage Expenses	-	-	2,822	2,822
Travelling & Conveyance	3,779	3,779	841	841
Printing & Stationery	6,756	6,756	9,275	9,275
Advertisement charges	6,375	-	6,375	6,375
Bank charges	290	290	2,624	2,624
Seed Money MACS TEF	2,00,000	2,00,000	-	-
Consultancy	1,25,880	-	-	-
TOTAL (RS.)	**6,92,407**	**3,81,418**	**1,08,726**	**1,08,726**

Schedules to and forming part of Receipts & Payments for the year ended on 31.03.2018

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

Amount - Rs.

PARTICULARS	CURRENT YEAR	PREVIOUS YEAR
Expenditure out of Earmarked Donations		
Prof. V.P Gokhale Award Expenses	13,133	17,110
Dr. R.B.Ekbote Award Expenses	10,605	10,850
Dr. P.P. Kanekar Award Expenses	-	6,243
Donation Expenses Prof. P.V.Sukhatme	750	750
Prof.S.P.Agharkar Chair Expenses	2,70,000	-
Home Garden Course Expenses	1,16,017	78,410
Prof. S.P. Agharkar Memorial Day Expenses	9,220	-
Science promotion Exps.	5,800	12,300
Smt. Parvatibai Agharkar Fellowship Award	26,710	-
TOTAL (RS.)	**4,52,235**	**1,25,663**

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

Schedules forming part of Receipt & Payment Account for the year ended on 31.03.2018

Schedule "J" : Indirect Receipts & Payments

Amount - Rs.

PARTICULARS	CURRENT YEAR		PREVIOUS YEAR	
	RECEIPTS	PAYMENTS	RECEIPTS	PAYMENTS
ARI Account	21,02,19,028	21,05,72,143	19,33,27,920	19,33,27,920
Schemes Account	34,09,716	37,30,137	1,17,48,565	1,17,48,565
Advance to staff	39,000	39,000	60,350	57,350
TDS Professional fees & Contractor	109	36,500	15,752	11,231
Medicline Research Pvt. Ltd.	-	-	1,544	-
Life membership Fees	-	-	500	-
TOTAL	**21,36,67,853**	**21,43,77,780**	**20,51,54,631**	**20,51,45,066**

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

Amount - Rs.

PARTICULARS	CURRENT YEAR	PREVIOUS YEAR
Expenditure out of Earmerked Donations	5,000	
Prof. V.P Gokhale Award Expenses	5,000	17,110
Dr. R.B.Ekbote Award Expenses	-	10,850
Dr. P.P. Kanekar Award Expenses	750	6,243
Donation Expenses Prof. P.V.Sukhatme	2,43,000	750
Prof.S.P.Agharkar Chair Expenses	85,558	-
Home Garden Course Expenses	5,800	78,410
Science promotion Exps.	26,710	12,300
Smt. Parvatibai Agharkar fellowship award		-
TOTAL (RS.)	**3,71,818**	**1,25,663**

Schedule "L" : Income From Other Sources

Amount - Rs.

PARTICULARS	CURRENT YEAR	PREVIOUS YEAR
Sale of Publication	1,775	-
Fee for Home Gardening Course	1,92,000	1,75,000
TOTAL (RS.)	**1,93,775**	**1,75,000**

As per our report of even date
For P M Patankar & Associates
Chartered Accountants
FRN :123794W

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

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

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

Sd/-
Prasad M Patankar
Partner
MRN : 113832

Place: Pune
Date: 27/8/2018

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

Schedules to and forming part of Balance Sheet as on 31.03.2018

Schedule "1" : Trust Fund or Corpus

Amount - Rs.

PARTICULARS	CURRENT YEAR	PREVIOUS YEAR
Trust/Corpus Fund	1,03,77,874	1,03,77,874
TOTAL(RS.)	**1,03,77,874**	**1,03,77,874**

Schedule "2" : Other Earmarked Funds

Amount - Rs.

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

Schedule "3" : Other Liabilities

Amount - Rs.

PARTICULARS	CURRENT YEAR	PREVIOUS YEAR
Advance payable to Mr B.K. Kale	-	886
Audit fees payable	3,450	3,450
Medclin Research Pvt. Ltd	2,70,992	2,70,992
TDS Payable	22,10,018	14,27,593
Sundry Creditors	6,375	-
TOTAL (RS.)	**24,90,835**	**17,02,921**

Schedule "4" : Income & Expenditure Account

Amount - Rs.

PARTICULARS	CURRENT YEAR		PREVIOUS YEAR	
Opening Balance	1,54,70,014		1,39,85,709	
Surplus carried over to Balance sheet	7,64,882		14,84,305	
		1,62,34,896		1,54,70,014
TOTAL (RS.)		**1,62,34,896**		**1,54,70,014**

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

Schedules to and forming part of Balance Sheet as on 31.3.2018

Schedule "5" : Immovable Properties

Amount - Rs.

SR No	Particulars	Rate of Depreciation	GROSS BLOCK			DEPRECIATION BLOCK					WDV as on 31.03.2018
			Cost as on 01.04.17	Additions during the year	Total Cost as on 31.03.2018	Upto 31.3.2017	Dep. On opening Balance	Dep. On the Additions during the year	Total Dep.for the Year	Total as on 31.03.2018	
1	Land at Pune		96,500	-	96,500	-	-	-	-	-	96,500
2	Land at Songaon		88,19,437	-	88,19,437	-	-	-	-	-	88,19,437
5	Land Development Expenses at Hol		2,02,583	-	2,02,583	-	-	-	-	-	2,02,583
3	Biometry Building	2.50%	1,15,200	-	1,15,200	95,870	2,880	-	2,880	98,750	16,450
4	Microbiology Building	2.50%	3,389	-	3,389	2,902	85	-	85	2,987	402
	TOTAL (RS.)		**92,37,109**	**-**	**92,37,109**	**98,772**	**2,965**	**-**	**2,965**	**1,01,737**	**91,35,372**

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

Schedules to and forming part of Balance Sheet as on 31.3.2018

Schedule "6" : Furniture and Dead Stock

Amount - Rs.

PARTICULARS	GROSS BLOCK			DEPRECIATION BLOCK						
	Cost as on 1.4.2017	Additions during the year	Total cost as on 31.03.2018	Rate of Depreciation	Up to 31.3.2017	Dep. On opening Balance	Dep. On the Additions during the year	Total Dep.for the Year	Total as on 31.03.2018	WDV as on 31.03.2018
1	2	3	4	5	6	7	8	9	10	11
A)(I) GENERAL										
1. Office Equipments & Furniture & Sports Items	5,89,242		5,89,242	10%	4,08,726	58,924	-	58,924	4,67,650	1,21,592
2. Apparatus & Equipments	3,15,076		3,15,076	20%	2,26,821	63,015	-	63,015	2,89,836	25,240
3. Electric Fittings	9,870	-	9,870	10%	9,869	-	-	-	9,869	1
4. Books	1,19,522	-	1,19,522	20%	1,16,441	1	-	1	1,16,442	3,080
5. Y -Type System for Grapes- Hol	1,10,497	-	1,10,497	10%	77,350	11,050	-	11,050	88,400	22,098
6. Construction of Statute	98,090	-	98,090	2.5%	9,808	2,452	-	2,452	12,260	85,830
SUB TOTAL (A)(I)	**12,42,297**	**-**	**12,42,297**		**8,49,015**	**1,35,442**	**-**	**1,35,442**	**9,84,457**	**2,57,841**
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
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)	**12,49,879**	**-**	**12,49,879**	**0%**	**8,52,482**	**1,35,442**	**-**	**1,35,442**	**9,87,924**	**2,61,956**

Amount - Rs.

PARTICULARS	GROSS BLOCK			DEPRECIATION BLOCK						
	Cost as on 1.4.2017	Additions during the year	Total cost as on 31.03.2018	Rate of Depreciation	Up to 31.3.2017	Dep. On opening Balance	Dep. On the Additions during the year	Total Dep.for the Year	Total as on 31.03.2018	WDV as on 31.03.2018
1	2	3	4	5	6	7	8	9	10	11
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. Aparatus & 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)	**13,10,212**	**-**	**13,10,212**		**9,12,503**	**1,35,442**	**-**	**1,35,442**	**10,47,945**	**2,62,268**

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 31 March, 2018 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 carried old outstanding balances carrying since last few year confirmation of which are not available and impact of the same on Financial Statement cannot he quantified. Party ledger balances are subject to confirmation & subsequent adjustments if any.
2. Fixed Assets and Closing Stock as on 31st March, 2018 has been Included in the financial statements as taken, valued and certified by the management of the Institute 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 2018

   ii) In the case of the Income and Expenditure Account of the Deficit 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 P M Patankar & Associates
Chartered Accountants
FRN :123794W

Sd/-
Prasad M Patankar
Partner
MRN : 113832

Place: Pune
Date: 27/8/2018

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

Balance Sheet as on 31.03.2018

Amount - Rs.

Particulars	Sch	Current Year	Previous Year
CORPUS/CAPITAL FUND AND LIABILITIES:			
CORPUS/CAPITAL FUND	1	11,09,88,544	6,30,90,530
RESERVES AND SURPLUS	2	-	-
EARMARKED/ENDOWMENT FUNDS	3	8,44,27,530	7,45,34,200
SECURED LOANS AND BORROWINGS	4	-	-
UNSECURED LOANS AND BORROWINGS	5	-	-
DEFERRED CREDIT LIABILITIES	6	-	-
CURRENT LIABILITIES AND PROVISIONS	7	14,89,99,767	16,56,37,030
TOTAL		**34,44,15,841**	**30,32,61,760**
ASSETS:			
FIXED ASSETS	8	17,76,44,647	15,81,75,791
INVESTMENTS-FROM EARMARKED/ENDOWMENT FUNDS	9	15,02,18,803	7,97,26,866
INVESTMENTS-OTHERS	10	-	-
CURRENT ASSETS,LOANS,ADVANCES ETC.	11	1,65,52,392	6,53,59,103
MISCELLANEOUS EXPENDITURES (to the extent not written off or adjusted)		-	-
TOTAL		**34,44,15,841**	**30,32,61,760**
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

Place: Pune
Date: 27/8/2018

As per our report of even date
For P M Patankar & Associates
Chartered Accountants
FRN :123794W

Sd/-
Prasad M Patankar
Partner
MRN : 113832

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

Income & Expenditure Account for the Year ended 31.03.2018

Amount - Rs.

Particulars	Sch	Current Year	Previous Year
Income			
Income from Sales/Services	12	32,45,900	29,24,139
Grants/Subsidies	13	16,67,99,980	18,54,36,105
Fees/Subscriptions	14	4,00,588	2,17,806
Income from Investments(Income on Invest. From earmarked/endowment Funds transferred to Funds)	15	-	-
Income from Royalty,Publications etc.	16	49,055	67,905
Interest Earned	17	16,44,207	36,90,373
Other Income	18	6,06,072	5,31,617
Increase/(decrease) in stock of Laboratory consumables	19	(2,89,200)	5,79,753
Donation Received in kind (Equipment)		-	-
Total (A)		**17,24,56,602**	**19,34,47,698**
Expenditure			
Establishment Expenses	20	14,21,80,132	12,34,95,354
Other Administrative Expenses etc.	21	4,17,91,956	3,77,63,257
Expenditure on Grants, Subsidies etc.	22	-	-
Interest	23	-	-
Depreciation (Net Total at the year-end corresponding to schedule 8)	8	58,16,525	1,15,98,499
Total (B)		**18,97,88,614**	**17,28,57,110**
Balance being excess of Income over Expenditure (A-B)		(1,73,32,012)	2,05,90,588
Transfer to Capital Fund (for capital expenditure Schedule D)		-	1,79,84,014
BALANCE BEING SURPLUS/(DEFICIT)CARRIED TO		-	1,79,84,014
CORPUS/CAPITAL FUND		**(1,73,32,012)**	**26,06,574**
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 ARI

Sd/-
OFFICIATING DIRECTOR
MACS ARI

As per our report of even date
For P M Patankar & Associates
Chartered Accountants
FRN :123794W

Sd/-
Prasad M Patankar
Partner
MRN : 113832

Place: Pune
Date: 27/8/2018

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

Schedules Forming Part of Balance Sheet as at 31.03.2018

Schedule 1: Corpus/Capital Fund

Amount - Rs.

Particulars	Current Year		Previous Year	
Corpus Fund				
Balance as the beginning of the year	6,30,90,530		4,24,99,942	
Add : Contributions towards Corpus/ Capital Fund (Schedule D)	2,85,52,569		1,79,84,014	
Add/ (Deduct) : Balance of Net Income/ (Expenditure)	(1,73,32,012)	7,43,11,087	26,06,574	6,30,90,530
Capital Fund				
Balance as the beginning of the year	2,36,40,075		-	
Add: Capital Grant during the year	4,00,35,000		-	
Add: Interest Received	15,54,951		-	
Less: Expenditure during the year	2,85,52,569		-	
		3,66,77,457		-
Balance at the end of the year		**11,09,88,544**		**6,30,90,530**

Schedule 2: Corpus/Capital Fund

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.)	**-**	**-**		**-**

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

Schedules Forming Part of Balance Sheet as at 31.03.2018

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	7,37,47,400	6,57,301	2,560	1,26,939	7,45,34,200	6,43,19,932
b> Additions to the funds:	-	-	-	-	-	-
i) Donations/grants	-	-	-	-	-	-
ii) Income from investments made on account of funds.	58,73,076	20,624	-	-	58,93,700	46,98,810
iii) Culture Identification Charges	-	-	-	-	-	17,19,106
iv) Overhead Charges from Scheme	42,93,525	-	-	-	42,93,525	18,85,479
v) Interest received on Funds from various projects	7,08,643	-	-	-	7,08,643	-
vi) Other Misc.	9,39,802	-	-	-	9,39,802	23,69,173
TOTAL (a+b)	**8,55,62,446**	**6,77,925**	**2,560**	**1,26,939**	**8,63,69,870**	**7,49,92,500**
c> Utilisation/Expenditure towards objectives of funds	-	-	-	-	-	-
i> Capital Expenditure	-	-	-	-	-	-
Fixed Assets	-	-	-	-	-	-
Others	-	-	-	-	-	-
ii> Revenue Expenditure	-	-	-	-	-	-
Salaries,Wages and allowances etc.	18,91,840	-	-	-	18,91,840	-
Rent	-				-	
Other Administrative Expense	50,000	-	500	-	50,500	4,58,300
					-	
TOTAL (c)	**19,41,840**	**-**	**500**	**-**	**19,42,340**	**4,58,300**
NET BALANCE AS AT THE YEAR-END (a+b-c)	**8,36,20,606**	**6,77,925**	**2,060**	**1,26,939**	**8,44,27,530**	**7,45,34,200**

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

Schedules Forming Part of Balance Sheet as at 31.03.2018

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 5: Deferred Credit Liabilities

Amount - Rs.

Particulars	Current Year		Previous Year	
a) Acceptance secured by hypothication 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**

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

Schedules Forming Part of Balance Sheet as at 31.03.2018

Schedule 7: Current Liabilities & Provisions

Amount - Rs.

Particulars	Current Year		Previous Year	
A. Current Liabilities :-				
1. Acceptances	-		-	
2. Sundry Creditors:				
a) For Goods		2,73,925		64,06,169
3. Advances Received	-		-	
4. Interest Accrued but not due on:	-		-	
a) Secured Loans/borrowings	-		-	
b) Unsecured Loans/borrowings	-		-	
5. Statutory Liabilities:	-		-	
a) TDS Payable	41,335		7,79,873	
b) Service Tax Output Payable	45,064		903	
c) PF Commissioner A/c	2,91,193		8,00,540	
d) P.F. New Pension Scheme	1,22,210		4,20,756	
e) State Profession Tax	1,600	5,01,402	26,400	20,28,472
6. Other current Liabilities	7,29,418	7,29,418	8,82,156	8,82,156
7. Unspent Balance of Grant	1,19,96,840		3,25,15,895	
8. Earnest Money Deposit	21,33,017		22,33,617	
9. Security deposit	12,68,198		8,66,226	
10. Other Tution Fees & University Share	1,69,818		1,52,383	
11. Recovery of Bank Loan	1,500		11,300	
12. Workshops Meetings etc.	11,64,111		20,55,715	
13. Scheme	-		7,15,421	
14. Retention Money	1,52,967	1,68,86,451	1,52,967	3,87,03,524
Total (A)		**1,83,91,196**		**4,80,20,321**

Particulars	Current Year		Previous Year	
1. For Taxation				
2. Gratuity	7,26,99,170		6,23,76,031	
3. Superannuation/Pension	-		-	
4. Accumulated Leave Encashment	4,83,47,312		4,74,44,164	
5. Trade Warranties/Claims	-		-	
6. Others	-		-	
- Salary payable for March	82,89,864		68,94,024	
- Audit fees	13,500		11,500	
- Electricity & Power	4,76,210		5,19,770	
- Postage & Telephone	1,13,265		41,178	
- Campus maintainance	1,09,370		1,15,457	
- Security Service Charges	3,01,271		28,234	
- Hired Labour Charges	2,58,609		1,86,351	
Total (B)		**13,06,08,571**	**-**	**11,76,16,709**
Total (A+B)		**14,89,99,767**		**16,56,37,030**

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

Schedules Forming Part of Balance Sheet as at 31.03.2018

Schedule 8 : Fixed Assets

Amount - Rs.

DESCRIPTION	GROSS BLOCK						DEPRECIATION					NET BLOCK	
	Cost/ valuation As at beginning of the year	Rate of Dep.	Delitions during the year	Net cost as on 31.3.2017	Additions during the year	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- Land at Hol	1,70,514	-	-	1,70,514	-	1,70,514	-	-	-	-	-	1,70,514	1,70,514
Land at Hol (Donated by G.O.M)	4,400	0	-	4,400	-	4,400	-	-	-	-	-	4,400	4,400
b> Leasehold													
2 BUILDINGS:			-	-	-	-	-	-	-	-	-	-	-
a> On Freehold	7,74,01,081	0	-	7,74,01,081	-	7,74,01,081	2,03,29,575	19,35,027	-	19,35,027	2,22,64,602	5,51,36,478	5,70,71,505
b> On Leasehold	-		-	-	-	-	-	-	-	-	-	-	
c> Ownership Flats/ Premises	-		-	-	-	-	-	-	-	-	-	-	
d> Superstructures on Land and not beloging to the entity	-		-	-	-	-	-	-	-	-	-	-	
e> Temprory Structures	23,12,701	2.5%	-	23,12,701	-	23,12,701	7,33,189	57,802	-	57,802	7,90,991	15,21,710	15,79,512
3 PLANT MACHINERY & EQUIPMENT	29,04,73,622	10% / 20%	14,200	29,04,59,422	89,93,929	29,94,53,351	22,00,70,821	1,12,257	11,90,001	13,02,258	22,13,73,079	7,80,80,274	7,04,02,803
4 VEHICLES	24,48,857	20%	-	24,48,857	-	24,48,857	21,33,281	-	-	-	21,33,281	3,15,575	3,15,575
5 FURNITURE,FIXTURES	2,29,48,075	10%	3,400	2,29,44,675	1,05,73,158	3,35,17,833	1,69,78,391	8,23,977	5,36,559	13,60,536	1,83,38,927	1,51,78,907	59,69,685
6 COMPUTER/PERIPHERALS	1,98,57,204	20%	-	1,98,57,204	2,58,536	2,01,15,740	1,88,27,983	-	48,527	48,527	1,88,76,510	12,39,230	10,29,221
7 COMPUTER SOFTWARE	31,32,350	60%	-	-	-	31,32,350	22,73,716	-	-	-	22,73,716	8,58,634	8,58,634
8 ELECTRIC INSTALLATIONS	74,26,518	10%/ 15%	-	74,26,518	79,34,679	1,53,61,197	69,71,166	3,76,660	3,96,734	7,73,394	77,44,560	76,16,637	4,55,353
9 LIBRARY BOOKS	93,08,343	20%	3,502	7,82,152	7,85,654	1,00,90,495	88,25,431	-	84,688	84,688	89,10,119	11,80,376	4,82,912
10 OTHER FIXED ASSETS	1,01,68,433	0	-	1,01,68,433	6,613	1,01,75,046	24,12,746	2,54,211	83	2,54,294	26,67,040	75,08,006	77,55,687
TOTAL OF CURRENT YEAR	**44,56,52,098**		**21,102**	-	**2,85,52,569**	**47,41,83,565**	**29,95,56,299**	**35,59,933**	**22,56,592**	**58,16,525**	**30,53,72,824**	**16,88,10,742**	**14,60,95,800**
PREVIOUS YEAR	40,37,35,187		19,662		1,79,84,014	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
TOTAL (A)	**44,56,52,098**		**21,102**	**-**	**2,85,52,569**	**47,41,83,565**	**29,95,56,299**	**35,59,933**	**22,56,592**	**58,16,525**	**30,53,72,824**	**16,88,10,742**	**14,60,95,800**
B CAPITAL W.I.P													-
CENTRAL PUBLIC WORKS DEPT	**1,20,79,991**		**79,34,679**	**-**	**46,88,593**	**-**	**88,33,905**	**-**	**-**	**-**	**-**	**88,33,905**	**-**
TOTAL (A+B)												**17,76,44,647**	-

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 31.03.2018

Schedule 9: Investments from Earmarked/ Endowemwnt 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)	8,22,11,879	7,94,71,865
8. Others (Fixed Deposits from Regular Grant-SBI & UBI)	6,77,51,923	-
TOTAL (Rs.)	**15,02,18,803**	**7,97,26,866**

Schedule 10: Investments - Others

Amount - Rs.

Particulars	Current Year	Previous Year
In Government Securities	0.00	0.00
Other approved Securities	0.00	0.00
Shares	0.00	0.00
Debentures and Bonds	0.00	0.00
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 31.03.2018

Schedule 11: Current Assets, Loans & Advances

Amount - Rs.

Particulars	Current Year		Previous Year	
A. CURRENT ASSETS:				
1. Inventories:				
a> Stores and Spares			-	
b> Publications	41,295		33,565	
c> Stock-in-trade of consumables (as taken valued and certified by the Management)	3,65,819	4,07,114	6,62,749	6,96,314
2. Sundry Debtors:				
a> Debts Outstanding for a period exceeding six months			2,19,126	
3. Cash balances in hand (including cheques/drafts and imprest)	53,350	53,350	2,00,375	4,19,501
4. Bank Balances:				
a> With scheduled Banks				
-On Current Accounts	(29,62,990)		1,18,83,291	
-On Deposit Accounts	-		-	
-On Savings Accounts	2,75,45,96		4,16,45,542	
- On Current Accounts(TDF)	5,58,606	3,50,213	40,71,591	5,76,00,425
b> With non-Scheduled Banks:				
-On Current Accounts	-		-	
-On Deposit Accounts	-		-	
-On Savings Accounts	-		-	
TOTAL (A)		**8,10,677**		**5,87,16,240**
B. LOANS, ADVANCES AND OTHER ASSETS				
1. Loans:				
a) Staff (For HBA, Vehicle Advance and Computer)	1,35,555		4,06,835	
d) Amount receivable from Schemes	40,82,244	42,17,799	1,97,639	6,04,474

Particulars	Current Year		Previous Year	
2. Advances and other amounts recoverable in cash or in kind or for value to be received:				
a> On Capital & Revenue Expenditure	-		9,17,383	
b> Prepayments(Cash Insurance)	1,284		1,283	
c> Advances to staff (For TA etc)	4,47,355		2,61,453	
e> Festival Advance	65,400		1,34,625	
f> Deposits kept with Govt. Agencies (MSEB, Telephone, Gas Cylinder etc.)	9,81,823	14,95,862	9,83,034	22,97,778
3. Income Accrued:				
a> On Investments from Earmarked/Endowment Funds	28,04,422		16,38,990	
b> On Loans and Advances (HBA, Vehicle Adv. & Computer Adv.)	12,550		33,695	
4. Claims Receivable	22,38,114		7,15,037	
5. GST Input /Service Tax Input	42,82,825		9,99,896	
6. Kumar Krishi Mitra Fellowship	31,281		31,281	
7. Royalty Receivable	-		10,000	
8. Amount Receivable from MACS	6,58,862	1,00,28,053	3,11,712	37,40,611
Total (B)		**1,57,41,714**		**66,42,863**
TOTAL (A+B)		**16,552,392**		**65,359,103**

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

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2018

Schedule 12: Income From Sales/Services

Amount - Rs.

Particulars	Current Year	Previous Year
1. Income from Sales		
a) Sales of Finished Goods (Farm Produce)	13,80,613	8,90,559
b) Sale of Raw Material	5,240	1,200
c) Sale of Scraps	17,364	510,993
2. Income from Services		
b) Cultural Identification Charges	16,01,433	14,59,207
d) Others	1,250	62,180
e) Testing fees-Soyabean/Wheat	2,40,000	-
Total (Rs.)	**32,45,900**	**29,24,139**

Schedule 13: Grants/Subsidies

Amount - Rs.

Particulars	Current Year	Previous Year
1. Central Government	16,99,21,000	19,32,00,000
Add: Unspent balance at the beginning of the year	88,75,820	2,47,52,000
Less: Unspent balance at the year end	1,19,96,840	3,25,15,895
	16,67,99,980	**18,54,36,105**
2. State Government	-	-
3. Government Agencies	-	-
4. Institutions/Welfare Bodies	-	-
5. International Organisations		-
6. Others (Specify)	-	-
Net Surplus of sale of Assets	-	-
Total (Rs.)	**16,67,99,980**	**18,54,36,105**

* Unspent balance of grant is against recurring balance & non-recurring balance is regrouped under Schedule I Capital Fund

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

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2018

Schedule 14: Fees/Subscriptions

Amount - Rs.

Particulars	Current Year	Previous Year
1. Entrance Fees (Library Membership fees)	62,000	28,600
2. Annual Fees (Licence fees)/Subscriptions	22,992	14,086
3. Seminar/Program Fees	-	-
4. Others (Ph.D. Tuition fee, Ph.D.Provisional Admission fee)	3,15,596	1,75,120
Total (Rs.)	**4,00,588**	**2,17,806**

Schedule 15: Income From Investments

Amount - Rs.

Particulars	INVESTMENT FROM EARMARKED FUND		INVESTMENT - OTHERS	
	Current	Previous	Current	Previous
INCOME FROM INVESTMENTS:				
(Income on Invest. From Earmarked/ Endowment Funds transferred to Funds.)	Year	Year	Year	Year
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/ ENDOWMENTFUND	**0.00**	**0.00**	**0.00**	**0.00**

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

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2018

Schedule 16: Income from Royalty, Publications, etc.

Amount - Rs.

Particulars	Current Year	Previous Year
1. Income from Royalty	-	-
2. Income from Publications	1,355	1,055
3. Others (Sale of Tender Forms/I Cards)	10,000	17,100
4. Application Money	37,700	49,750
Total (Rs.)	**49,055**	**67,905**

Schedule 17 : Interest Earned

Amount - Rs.

Particulars	Current Year	Previous Year
1. On Term Deposits		
a) With Scheduled Banks	12,58,626	35,28,487
b) With Non-Scheduled Banks	-	-
2. On Saving Accounts		
a) With Scheduled Banks	2,15,562	80,120
b) With Non-Scheduled Banks	-	-
c) Post Office Savings Accounts	-	-
3. On Loans		
a) Employees/Staff (On HBA, Vehicle and Computer Advance)	1,58,899	33,695
b) Intrest Received on L.C	11,120	48,071
4. Interest on Debtors and Other Receivables	-	-
Total (Rs.)	**16,44,207**	**36,90,373**

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	4,92,072	2,40,761
4) Miscellaneous Income	1,14,000	2,90,856
Total (Rs.)	**6,06,072**	**5,31,617**

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

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2018

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	3,65,819	6,62,749
- Finished Goods	-	-
- Publications	41,295	33,565
	4,07,114	6,96,314
b) Less: Opening Stock		
- Laboratory Consumables	6,62,749	90,701
- Finished Goods	-	-
- Publications	33,565	25,860
	6,96,314	1,16,561
Net Increase/(Decrease)	**(2,89,200)**	**5,79,753**

Schedule 20 : Establishment Expenses

Amount - Rs.

Particulars	Current Year	Previous Year
1) Salaries and Wages	9,92,27,313	9,32,29,955
2) Allowances and Bonus	9,83,979	8,01,257
3) Contribution to Provident Fund & New Pension Scheme	91,26,221	80,38,006
4) Contribution to Other Fund (D.L.I.F.)	51,225	49,175
5) Staff Welfare Expenses	14,57,576	39,15,512
6) Expenses on Employees Reitrement and Terminal Benefits	2,16,10,796	94,98,052
7) Stipend to Research & Fellowship Students	66,11,306	75,65,398
8) Encashment of Earned Leave for LTC	31,11,716	2,22,303
9) Reimbursement of Residential Telephone Expenses *	-	1,75,696
TOTAL	**14,21,80,132**	**12,34,95,354**

* Reimbursement of Residential Telephone Expenses -included in allowances and bonus for F.Y 2017-18.

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

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2018

Schedule 21: Other Administrative Expenses

Amount - Rs.

Particulars	Current Year	Previous Year
ADVERTISEMENT & PUBLICITY	1,83,017	3,76,786
AUDITORS REMUNERATION	9,300	11,500
ELECTRICITY & POWER	60,10,253	57,35,457
FARM EXPENSES	34,38,763	11,44,815
HOSPITALITY EXPENSES	3,99,205	2,62,892
INSURANCE	2,408	3,640
LEGAL & PROFESSIONAL FESS	10,96,771	8,30,654
OTHER OFFICE EXPENSES	6,60,064	2,39,771
POSTAGE, TELEPHONE & COMMUNICATION	6,47,052	6,11,750
PRINTING & STATIONERY	8,19,968	9,30,258
PURCHASES OF CHEMICALS & GLASSWARE	94,88,109	1,03,79,110
RENT RATES & TAXES	17,38,871	20,50,104
REPAIRS & MAINTENANCE	70,45,793	58,20,073
RETIRED STAFF MEDICAL EXPENSES	9,84,564	-
SECURITY & LABOUR EXPENSES	45,55,444	38,55,638
SEMINAR /WORKSHOP EXPENSES	2,29,653	4,32,877
SUBSCRIPTION FEES	23,25,484	23,30,026
TRAVELLING & CONVEYANCE	13,35,924	18,12,653
VEHICLE RUNNING AND MAINT EXPS	1,46,142	1,52,419
WATER CHARGES	6,75,172	7,01,154
LIVERIES	-	81,680
TOTAL (Rs.)	**4,17,91,956**	**3,77,63,257**

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

Schedules forming part of Income & Expenditure Account for the year ended 31.03.2018

Schedule 22: Expenditure on Grants, Subsidies etc.

Amount - Rs.

Particulars	Current Year		Previous Year	
a) Grants sgiven 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**

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**

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

Schedules Forming Part of Balance Sheet as at 31.03.2018

Schedule D: Transfer to Capital Fund

Amount - Rs.

Particulars	Current Year		Previous Year	
Other Fixed Assets				
Books	7,85,654		8,36,316	
Buildings	-		2,71,616	
Computer / Peripherials/Softwares	2,58,536		33,54,776	
Office Furniture & Dead Stock	1,05,73,158		10,01,527	
Other Fixed Assets	6,613		8,70,935	
App. & Equipments	89,93,929		1,16,48,844	
Electrical Installation	79,34,679		-	
		2,85,52,569		**1,79,84,014**

As per our report of even date
For P M Patankar & Associates
Chartered Accountants
FRN :123794W

Sd/-
Prasad M Patankar
Partner
MRN : 113832

Sd/-
FINANCE & ACCOUNTS OFFICER
MACS ARI

Sd/-
OFFICIATING DIRECTOR
MACS ARI

Place: Pune
Date: 27/8/2018

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 31.3.2018

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. 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 P M Patankar & Associates
Chartered Accountants
FRN :123794W

Sd/-
Prasad M Patankar
Partner
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Place: Pune
Date: 27/8/2018

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 31.3.2018

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:

Grants are recognized on receipts. Grants received from Department of Science & Technology (DST) for Creation of Capital Assets are treated as Capital Fund of the Institute. Grants received for General,

Salaries and Salaries-SC are treated as of revenue nature and shown under Income & Expenditure Account.

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.	Particular	For year ended 31st March 2018
1	Withdrawal Rate	2.00%
2	Discounting Rate	7.78%
3	Future Salary Rise	5.00%

The position of gratuity payable on death/retirement of employees and leave encashment as on 31st March, 2018 is as below

Particulars	Provision for Gratuity	Provision for Leave Encashment
Opening balance as on 31st March 2017	6,23,76,031	4,74,44,164
Add:- Addition during the year 2017-18	1,03,23,139	9,03,148
Less:- Deduction during the year 2017-18	.....	.....
Closing Balance as on 31st March 2018	7,26,99,170	4,83,47,312

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 P M Patankar & Associates
Chartered Accountants
FRN :123794W

Sd/-
Prasad M Patankar
Partner
MRN : 113832

Sd/-
FINANCE & ACCOUNTS OFFICER
MACS ARI

Sd/-
OFFICIATING DIRECTOR
MACS ARI

Place: Pune
Date: 27/8/2018

Illumination on the occasion of 72nd Independence Day

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