

**BIRAC**  
**innovators**  
*Creating an **Impact***



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# Foreword



All of us are rightly pleased that BIRAC, in its short history, continues to empower the biotechnology industry of the country and foster cutting edge innovation for affordable product development.

The Indian biotechnology sector is growing and is expanding its base as well as increasing its depth. There are perceptible indicators for growth in R&D patterns in the biotech industry. BIRAC has operationalised several pioneering funding schemes such as SBIRI and BIPP which have charted new territories in providing a range of support to the industry- from significant amount of funding to IP and technology transfer support. The two grant schemes are highly competitive and success in securing a grant has become an industry benchmark.

Communication of scientific R&D efforts to the wider network is important to public understanding of science as well as making society understand the importance and relevance of R&D to everyday life. The BIRAC compendium has successfully showcased the range of bioinnovations being conducted by industry either in-house or with partners including those with academia.

This compendium will help BIRAC and DBT to analyse and assess the impact of the targeted funding schemes on the biotechnology landscape of the country. It will also help to identify future growth areas and the magnitude of support that is required for India to fashion a bioeconomy.

Present and future bio-innovators will take inspiration from the innovation research that has been highlighted in the compendium. All of us at BIRAC wish them success in their journey.

**Prof. K VijayRaghavan**  
Secretary, DBT & Chairman BIRAC



# Preface



The establishment of BIRAC by the Department of Biotechnology, Ministry of Science & Technology, Govt. of India paved the way for providing focused support for growth of the Indian Biotechnology sector especially at a stage when the sector has reached an inflection point. The mission for BIRAC is to foster and empower the biotech enterprise, especially start-ups and SMEs of the country for development of affordable biotechnology products and services.

Over the years, two flagship schemes viz. SBIRI (operational since 2006) and BIPP (operational since 2009) have supported development of cutting edge technologies, products and infrastructure. These were complemented with BIG and CRS targeting the young entrepreneur and academic researcher.

This compendium provides a reflection of numerous case studies of Bio-innovations supported mostly through these schemes mainly SBIRI and BIPP. It is evident from the assessment of the two schemes that they have created visible impact, through public-private partnerships, especially in fostering high risk innovative R&D, catalysing collaborative efforts specifically between industry and academia. It is noteworthy to mention that industry's contribution in these schemes has been equally significant thus highlighting the fact that these two schemes are true representative of national policy of empowering the PPP model. Indeed, these two flagship schemes have set industry benchmarks for innovation.

The goal of fashioning an Indian bioeconomy that is USD \$100 billion in revenues is achievable if the correct ecosystem elements are strengthened. BIRAC's role in achieving this goal is to accelerate innovation. BIRAC has recently launched two focused programmes targeting alleviation of maternal and child health situation (MCH) – the Social Innovation Programme – SPARSH and the Grand Challenges in partnership with DBT and Bill & Melinda Gates Foundation. These programmes would spur innovations at all levels.

As we move forward, BIRAC looks forward to strengthening and creating new partnership with all stakeholders, industry, academia, public and private sector, national and international and other similarly aligned organisations, to make India the destination for Bio-innovations.

**Dr. Renu Swarup,  
MD, BIRAC & Adviser, DBT**



# Thinking Aloud

## Indian Biotechnology: A snapshot

India represents a fast growing nation with a knowledge led economy where biotechnology industry is expected to contribute its share of growth to the engine of Indian innovations. Indian biotechnology industry is a vibrant mix of nearly 500 firms spread across the country but mostly concentrated in the Southern hot spots of Bangalore and Hyderabad, however increasingly biotech activity is being observed in Pune, NCR and Chennai as well as in smaller cities such as Dharwad, Thiruvananthapuram and Bhubaneswar.

The recent 11th Biospectrum-ABLE annual survey of 2013 has revealed that the industry grew 15% over the previous financial year and the total revenues were INR 23,000 crores which is close to \$5 billion accounting for the fact that the rupee has depreciated considerably over the last year. Despite the global downturn, posting a 15% growth, points to an underlying vibrancy in the sector. The components of the Indian biotech industry include biopharma (biosimilars, vaccines, stem cells, medical devices and diagnostics), bioservices (contract research and manufacturing), bioagri (transgenics, MAS, and RNAi as well as livestock and fisheries), bioindustry (enzymes and bioremediation and secondary agriculture) and bioinformatics (next generation sequencing and big data analytics)

India continues to be strong in vaccines and drugs it is poised to take advantage of the emerging biosimilars scenario. It retains strong capabilities in manufacturing and contract research even

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though tough business climate affects the contract research organisation. Other sectors such as bio-agri, industrial biotechnology and bioinformatics have shown growth as well despite the downturn and several Indian innovative biotech firms are pushing the frontiers of biotechnology to bring products and services that are relevant for current and future challenges that we as a nation face.

## **India: A \$100 billion dollar bioeconomy by 2025?**

The ABLE-DBT Report in 2012 set a stretched goal for the industry to touch US \$100 billion by 2025 and significantly contribute to the economy of India and transforming it to a bio-economy.

This goal is achievable if the underlying foundations are strong. These foundations lie in effective R&D, growing pool of novel ideas, a non-convoluted path for commercialisation and empowering the biotech enterprise through funding as well as in areas such as access to technology transfer and IP. Further, another key issue is connecting several elements of the innovation system to make the country an efficient innovation machine which understands the needs of society and endeavours to bring high quality but affordable products.

## **BIRAC's role in ushering an Indian bioeconomy: weaving the bioeconomy innovation lattice**

BIRAC, since its inception, has focused on creating an impact in the biotechnology sector of the country through specialised funding modalities that span support from idea generation to pilot and large scale validation besides offering immense support for developing critical infrastructure. Thus, BIRAC is weaving a lattice of innovation ecosystem.

Two pioneering schemes have helped create a platform for industry as well as for academia from where the nation can now strategise to become a bioeconomy. These schemes are Small Business Innovation Research Initiative (SBIRI) which was launched in 2006 and Biotechnology Industry Partnership Programme (BIPP) which was initiated in 2009.

SBIRI has been focused on fostering incremental innovation that could become critical inflection points during product development cycle while BIPP has the mandate to leapfrog nationally relevant cutting edge novel technology to novel products.

Both these schemes have been a trendsetter in the industry. SBIRI has funded 105 biotech firms while BIPP funding has been extended to 91 biotech firms. Together these two schemes have committed over US \$200 million over 5 years. The two schemes have continued to fund a whole range of innovations spanning healthcare (cancer, infectious, diabetes, cardiovascular and diagnostics), bioagri (field trials, transgenics, MAS, RNAi and secondary agriculture) and bioindustrial (bioenzymatic process, chemical conversion, fermentation). Besides the schemes have also supported development of infrastructure which is critical for growth of bioeconomy.

## **The BIRAC Compendium**

The present BIRAC compendium provides a snapshot of several innovative projects which have been supported under SBIRI/BIPP and some recent funding schemes such as CRS and BIG. Each case study outlines the innovation challenge, the team involved and provides information on how BIRAC funding helped bridge the innovation challenge. The compendium also highlights the impacts of these two flagship SBIRI and BIPP schemes and provides a whole host of statistics related to the two schemes.





PROFILES

**BIRAC**  
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**Title of Innovation :** Percutaneous Aortic Valve (PAV) Technology [Funded under Scheme: BIPP]  
**Collaborating Partners :** None



## Team Members

Dr. Mohan Thanikachalam  
Dr. George Joseph  
Dr. R. K. Ramanathan  
Ms. Ranjitha Rebecca Jeeven

## Brief Description of the Innovation

**Stage of Development:** Proof-of-Concept

**Innovative element (s):** PAV implantation is a minimally invasive technique for the treatment of diseased aortic valve. We aim to design a self-expanding PAV comprising of a tissue valve sutured onto a stent frame with a minimum crimp profile to facilitate transfemoral access, while ensuring adequate radial force to prevent device migration and/or paravalvular leak.

**Market Potential:** PAV technology will eliminate the need for major surgery and the associated complications, and thus reduce patient's discomfort, recovery time and treatment related costs. Once the PAV technology is developed, it has the potential to expand and capture 46% of the current aortic valve market.

**Risk factor:** Potential complications are bleeding during incision at the groin, stent migration leading to occlusion of coronary ostium, dislodgement of calcified plaque during deployment leading to stroke, infection and thrombus formation. Designing a stent that conforms to the aortic annulus with least amount of trauma, identifying a biomaterial that will act as a good sealant and the development of a low profile deployment system will minimize or eliminate these potential complications

**National/ Societal Relevance:** An estimated one million patients worldwide suffer from symptomatic aortic heart valve disease, which results in 200,000 surgical aortic valve replacements annually worldwide. We have designed a PAV with a bovine tissue valve sutured onto a nitinol (shape-memory alloy) stent frame, which has a unique design that leads to high radial force that can withstand maximal blood pressure and thus lead to reliable, secure implantation (similar to a surgically implanted valve). At the same time, PAV has a low profile when crimped, which will lead to easy deployment percutaneously through the femoral artery, thus avoid the need for open-heart surgery.

**Potential for IP generation:** Once developed an international patent for the same would be obtained.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** We have completed the design validation of the PAV. We are in the process of prototyping the device and conducting further in vitro and in vivo testing.

**Plan to take innovation further:** Once done, we plan to apply for regulatory approval for human trial.

**Level of Satisfaction:** 8/10

## Address

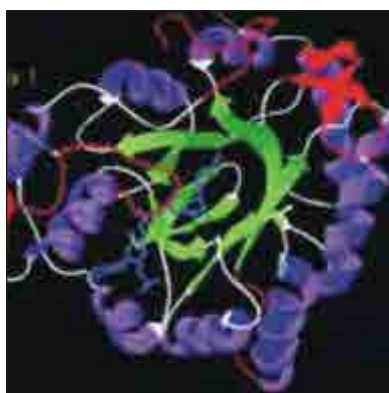
Agada Medical Technologies  
No104/5, Arihant VTN Square  
G. N. Chetty Road, T. Nagar,  
Chennai - 600017, Tamil Nadu



## **Title of Innovation:** Ketoreductases-whole cell biotransformation for chiral chemistry

[Funded under Scheme: BIPP]

Collaborating Partners: Cellworks Research India Pvt. Ltd.



### **Team members (including collaborators)**

Dr Shalaka Samant  
Dr Sunil Kumar Sukumara  
Dr. Ganesh Sambasivam  
Dr SathishSadagopan  
Dr Kannan Thanukrishnan Mahesh  
Mr. Saiful-Haq  
Dr AnandAnandkumar  
Dr. SantanuDatta  
Dr. Nainesh  
Ms. Ragini Singh  
Ms. Swati Khandewal  
Ms. Sanjana  
Ms Ramanujan

### **Address**

Anthem Biosciences Pvt. Ltd.  
with Cellworks Pvt. Ltd.  
No 49, Canara Bank Road,  
Bommasandra Industrial Area,  
Phase 1, Hosur Road, Bangalore  
560 099, Karnataka

## **Brief Description of the Innovation**

**Stage of Development:** Validation

**Innovative element (s) :** We have cloned and expressed certain ketoreductases described in the literature in *E. coli* for carrying out whole cell reduction of 5 industrially relevant prochiral ketones and high value pharmaceutical intermediates. In order to address the stoichiometric requirement for co-factors to support such ketoreductions, we have attempted to use a novel approach of deleting genes whose products are known to extensively utilize cellular NADH/NADPH. This has led to the generation of *E. coli* strains that are now being analysed for their capacity to provide a sustained supply of cofactors to support the asymmetric reduction of prochiral ketones when ketoreductases are overexpressed in these strains. In addition, an attempt to channel the bacterial metabolic pathways using appropriate media conditions to generate sufficient co-factors was found to be useful in enhancing the efficiency of ectopically expressed ketoreductases. Such an approach for co-factor enrichment is novel and would lend itself to large scale whole cell ketoreductions obviating the need for addition of expensive co-factors.

**Market potential:** KetoReductases (KRED's) yield a current market value of 5 Billion USD. It is projected that this amount is set to increase to about 60 Billion USD by 2020. With such a high rate of growth for the KRED segment, it makes business sense that the current proposal is focused on this space. Engineering whole cell hosts those express KREDs that are capable of taking in pro-chiral substrates to reduce them to chiral alcohols. It is an area that will have a positive impact on business potentials. It is also an area that will allow India to become a technology leader in Green Chemistry.

**Risk factor:** The basic assumptions of the project was that if we can knockout the high flux non-essential cofactor (NADH/NADPH) utilizing pathways, then the enrichment can be utilized solely for the synthesis of chiral intermediates. Our ongoing analysis indicates that this logical assumption could be correct. It might be difficult to convert some prochiral molecules into the chiral form. This may be due to the low solubility, low permeability and toxicity issues. The former might be improved by use of cosolvents but improving permeability by using specific mutant (tol strains) is still unproven and if the prochiral or the chiral molecule is toxic to the growth of the bacteria, then it might hinder the transformation.

**National/Societal Relevance:** Production of chiral alcohols in India is carried out mainly using chemical means. The development of indigenous cutting edge whole cell biotransformations to synthesize chiral alcohols is of national importance as • they are easily scalable • reduce process costs and • avoid the use of toxic and/or hazardous substances, thereby promoting "Sustainable technologies".

**Potential for IP generation:** The proposed evaluation of ketoreductases from various microbial sources to reduce 5 industrially relevant ketones in vitro will identify highly efficient tools that catalyze specific ketoreduction. These ketoreductases have been engineered for generating strains amenable to whole cell reduction. The evaluation of ketoreductase expressing *E. coli* strains will identify a combination of factors that facilitates optimal use of cellular NADH/NADPH to give enhanced yields following whole cell reduction. Thus, the proposal aims to identify highly efficient, industrially relevant ketoreductases and exploit the same by coupling it with strategies that combine effective utilization of cellular NADH/NADPH for whole cell reduction with the power of the ketoreductases identified in this screen

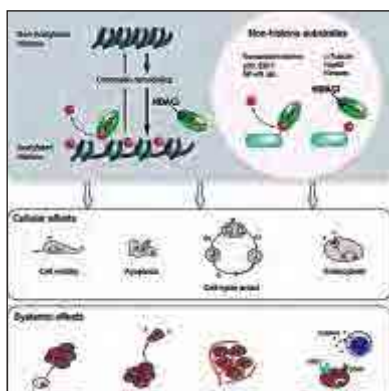
### **PERFORMANCE EVALUATORS**

**Progress Quantifier:** The project entails the generation of a biological system wherein an increase in co-factors such as NADH/NADPH facilitate an efficient enzymatic process of ketoreduction. We have successfully established biochemical conditions wherein Sorbitol when used as the sole carbon source generates excess co-factors and thereby promotes the ketoreductase activity.

**Plan to take the innovation further:** Having narrowed down on genes that could play a role in biochemical pathways that use up cellular NADH/NADPH we have now generated mutants in which these specific genes have been knocked out. We are currently in advanced stages of validation with regards to testing these mutants (gene knock outs) for their increased ketoreductase activity due to the availability of increased co-factors

**Level of Satisfaction:** 8/10

**Title of Innovation:** PAT-1102- A Novel HDAC inhibitor for cancer therapy [Funded under Scheme: BIPP]  
**Collaborating Partners:** Mitra Biotech Pvt. Ltd. Bangalore



## Team Members (including Collaborators)

Dr. Ganesh Sambasivam  
Dr. Prasad Shivarudraiah  
Mr. Govindarajulu G  
Mr. Jagadheshan H  
Dr. Pradip Majumder  
Dr. Padhma Radhakrishnan  
Dr. Biswanath Majumder  
Dr. Misti Jain  
Dr. Saravanan Tiyyagarajan

## Address

Anthem Biosciences Pvt. Ltd.  
with Mitra Biotech Pvt. Ltd.  
No 49, Canara Bank Road,  
Bommasandra Industrial Area,  
Phase 1, Hosur Road,  
Bangalore - 560 099, Karnataka

## Brief Description of the Innovation

**Stage of Development:** Discovery and Proof-of-concept.

**Innovative element (s):** PAT-1102 is a novel HDAC inhibitor that has shown anticancer activity against a variety of human tumor cell lines. PAT-1102 has demonstrated anti-tumor activity in human cancer models such as lung carcinoma and colorectal cancers in experimental models. Pre-clinical efficacy is comparable or better than an approved HDAC that is Vorinostat (Zolinza). Toxicity studies indicated that PAT-1102 has better safety profile compared to approved HDACs.

**Market potential:** PAT-1102 has a major application in pharmaceutical / biotech industry for anticancer therapy as monotherapy or combination therapy with marketed anticancer drugs. The global anticancer market was \$70 billion in 2008. The targeted cancer drug market will double in value, from \$25 billion in 2008 to \$51 billion in 2015.

**Risk factor:** Toxicity or ADME related problems could be encountered during the development. In the event of this, plans are in place to develop a backup molecule PAT-1118.

**National/ Societal Relevance:** Cancer prevalence in India is estimated to be around 2.5 million, with over 8,00,000 new cases and 5,50,000 deaths occurring each year due to this disease in the country (National Cancer Registry Programme, ICMR). There is a strong unmet medical need to develop newer anti-cancer therapies. Further, targeted cancer therapy is very expensive and cannot be affordable by most of the cancer patients in India. PAT-1102 is expected to offer safe and affordable cancer therapy to cancer patients in India.

**Potential for IP generation:** The molecule is a structurally novel HDAC inhibitor and has strong IP protection in India, US, Japan, Western Europe and several other countries. Patent details: WO 2011/021209 A1, HISTONE DEACETYLASE INHIBITORS

## PERFORMANCE EVALUATORS

**Progress Quantifier:** All the project milestones in the first phase have been successfully completed within the stipulated time and allocated budget. Significant progress has been made in the preclinical development of PAT-1102. An optimized back-up compound was identified as well.

**Plans to take the innovation further:** As part of the second phase of the project, IND enabling studies are being planned for IND submission and the program is well on course to reach First-in-human (FIH) studies.

**Level of Satisfaction:** 9/10



**Title of Innovation:** Single tube nested PCR kit for White spot syndrome virus (WSSV), Infectious hypodermal and hematopoietic necrosis virus (IHHNV), and Yellow Head Virus (YHV) [Funded under Scheme: SBIRI]  
**Collaborating Partners:** Department of Biochemistry, Central College Campus, Bangalore University.



## Team Members (including Collaborators)

Dr. C. R. Subhashini  
Dr. V. R. Devaraj  
Mr. S. Sudheer Kumar  
Mrs. Hansa Pramod  
Ms. Deepa Shenoy

## Brief Description of the Innovation

**Stage of Development:** Commercialization

**Innovative element (s):** The WSSV kit is based on Single tube nested PCR which has an advantage over the existing two tube nested PCR in terms of 1) reduced contamination 2) The different levels of infection can be ascertained 3) The internal control in the kit will help to check the false negatives due to PCR inhibition and loss of DNA. There is no indigenous RT-PCR kits available for YHV and the imported YHV kit does not detect Indian strains. The indigenous kits with features to improve the robustness of the kit will be economical to the Indian aquaculture industry.

**Market potential:** These diagnostic agents will be of great use because the shrimp industry is export oriented and the farmers are aware of the use of PCR techniques for early diagnosis of viruses. There is great need for indigenously developed kits for these viruses.

**Risk factor:** Competition from companies selling imported kits

**National/ Societal Relevance:** Use of these kits will help in control of killer viral diseases of the shrimp. The production and the export revenue in turn will go up. These kits can be exported to countries where aquaculture is done and will help in earning export revenue.

**Potential for IP generation:** Two patents have been filed for the primer sequences of the viruses

## PERFORMANCE EVALUATORS

**Progress Quantifier:** Launch of proposed kits, customer feedback and Filing patents

**Plans to take the innovation further:** Export of the kits to south east Asian countries

**Level of Satisfaction:** 8/10

## Address

Aristogene Biosciences Pvt. Ltd  
A-67(A), 1st CROSS,  
Rajaji Nagar Industrial Estate,  
Bangalore-560044



**Title of Innovation:** Detailed Chemical Profiling and Pre-Clinical Evaluation of a US-patented Antidiabetic Plant Extract [Funded under Scheme: SBIRI]  
Collaborating Partners: None



#### Team Members

Dr. Benny Antony  
Dr. Merina Benny  
Dr. Binu T Kuruvilla  
Dr. T.N.B. Kaimal  
Ms. Rosmi Kunjachan  
Dr. Nishant Gupta

## Brief Description of the Innovation

**Stage of Development:** Discovery and proof of concept

**Innovative element (s):** Preliminary studies have shown that methanol extract of the plant has antidiabetic activity. Animal experiments designed to test this effect have demonstrated that the extracts of the plant have potent antidiabetic effect. The proposal involves extraction and standardisation of the US patented antidiabetic plant extract, preclinical trials and toxicology studies resulting in a potent herbal antidiabetic drug.

**National/ Societal Relevance:** This is important because India is having a huge diabetic population which looks forward to an antidiabetic drug of natural origin. It is envisaged that the antidiabetic drug from *Costus pictus* will benefit both Type I and Type II diabetic patients.

**Potential for IP generation:** ANEL has already identified and US patented an antidiabetic herbal plant, *Costus pictus*.

## PERFORMANCE EVALUATORS

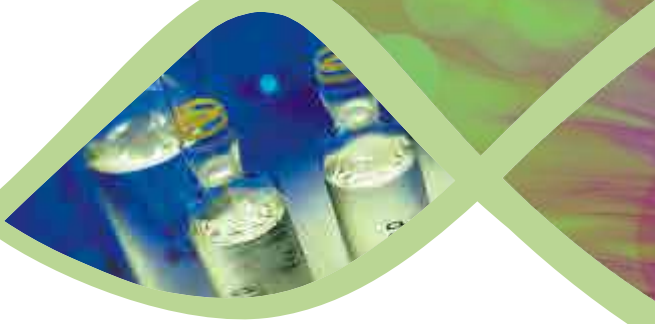
**Progress Quantifier:** The indicators of progress in the proposal includes botanical identification of *Costus pictus*, pharmacoepidemiological data to confirm its folk usage, standardization of plant extract, antidiabetic efficacy evaluation and ready next phase of human clinical trials. ANEL has the capability of successfully developing and commercialising an antidiabetic drug from the present leads.

**Plans to take the innovation further:** Product development

**Level of Satisfaction:** 8/10

#### Address

Arjuna Natural Extracts Ltd  
P. B. No:126, Bank Road,  
Alwaye,  
Kerala - 683101



**Title of Innovation:** A Multicentre, Parallel Randomised (2:1) Open Label Phase III Clinical Study To Evaluate The Immunogenicity and Safety Of BE's Inactivated JE Vaccine In Healthy  $\geq 1$  To  $< 3$  Year Old Indian Subjects In Comparison With Purified Inactivated JE Vaccine (IXIARO®) Of Intercell – An Non-Inferiority Study. [Funded under Scheme: BIPP]  
**Collaborating Partners:** None



**Team Members**  
Dr. Kishore

**Address**  
Biological E. Ltd  
18/1&3,  
Azamabad,  
Hyderabad - 500020

**Brief Description of the Innovation**

**Stage of Development:** Commercialization

**Innovative element (s):** This is the first inactivated Japanese encephalitis vaccine licensed in India.

**Market potential:** Currently ~ 10 crores and expected to grow at a CAGR of 12%

**National/ Societal Relevance:** This vaccine is licensed in the age group of  $< 1$  to  $< 3$  yrs & 18 to 49 yrs age group. Company has plans to license this in 3 – 18 yrs as well

**Potential for IP generation:** Bio E's JE vaccine has been commercialized in India and we have obtained WHO pre-qualification this year

**PERFORMANCE EVALUATORS**

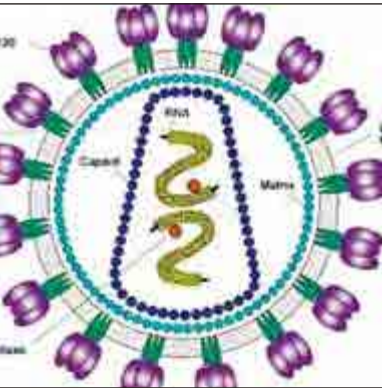
**Progress Quantifier:** Vaccine already licensed in India.

**Plans to take the innovation further:** As stated above company plans to cover the age group of 3 – 18 yrs as well.

**Level of Satisfaction:** 9/10



**Title of Innovation:** Development of Mycobacterium an adjuvant for anti – rabies vaccine [Funded under Scheme: SBIRI]  
**Collaborating Partners:** None



**Team Members  
(including Collaborators)**  
Dr. Bakulesh Khamar  
Mr. Nirav Desai  
Dr. Seema Sharma

**Address**  
Cadila Pharmaceuticals Limited  
Sarkhej - Dholka Road,  
Bhat,  
Ahmedabad-382 210

### Brief Description of the Innovation

**Stage of Development:** Proof-of-Concept

**Innovative element (s) :** Novel indigenous vaccine adjuvant. Currently vaccine adjuvants are proprietary and not easily available to all concerned

**Market potential:** India registers 36% of global Rabies mortality with over 20,000 deaths annually and has the highest disease burden (2.74 per 100,000 population) in the world. The current rabies vaccines are without vaccine adjuvants. For post exposure prophylaxis using currently available vaccines and standard practice five injections need to be administered over one month. The associated cost and inconvenience leads to non-compliance with majority receiving first three injections only. It is possible to achieve compliance using adjuvants with current vaccines. If done it will improve compliance and reduce costs associated with five administrations and reduce mortality due to noncompliance.

**Risk factor:** Procurement of antigen, Regulatory Hurdles

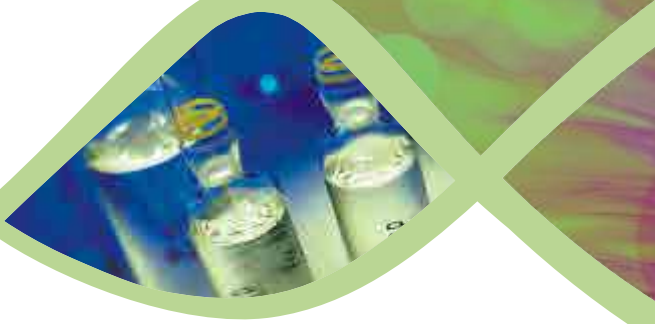
**Potential for IP generation:** Exists

### PERFORMANCE EVALUATORS

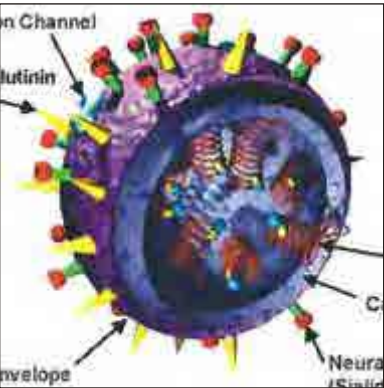
**Progress Quantifier:** Successfully completed

**Plans to take the innovation further:** The efforts to procure source of antigen have not been successful

**Level of Satisfaction:** 9/10



**Title of Innovation:** Clinical Development of Influenza Vaccines [Funded under Scheme: BIPP]  
**Collaborating Partners:** None



**Team Members  
(including Collaborators)**  
Dr. Bakulesh Khamar  
Dr. Deepak Sawhney  
Dr. Sudeep Srivastava  
Mr. Nirav Desai  
Dr. Seema Sharma

**Address**  
Cadila Pharmaceuticals Limited  
Sarkhej - Dholka Road,  
Bhat,  
Ahmedabad-382 210

**Brief Description of the Innovation**

**Stage of Development:** Commercialization

**Innovative element (s):** This is a novel vaccine approach. Such vaccines are not approved anywhere in the world.

**Market potential:** Currently no indigenously manufactured vaccine available

**Risk factor:** Delays due to regulatory hurdles

**National/ Societal Relevance:** Provides novel vaccine produced in India. The last pandemic though not fatal created urgency to have indigenous capability. This is most needed in time of pandemic influenza. The approach also provides faster response time during Pandemic situation compared to conventional approaches.

**PERFORMANCE EVALUATORS**

**Progress Quantifier:** Successfully completed phase – II trial

**Plans to take the innovation further:** Phase III clinical trials are planned and will be conducted following regulatory approvals

**Level of Satisfaction:** 8/10



**Title of Innovation:** Development of novel microfluidics based flow analyser  
[Funded under Scheme: BIPP]  
Collaborating Partners: IIT- Madras



**Team Members  
(including Collaborators)**  
Dr. Taslimarif Saiyed  
Dr. Anil Prabhakar  
Dr. Sudip Mondal  
Dr. H. Krishnamurthy  
Mr. Nilesch

**Address**  
Centre for Cellular and Molecular  
Platforms (C-Camp)  
NCBS-TIFR, GKVK Post,  
Bellary Road, Bangalore - 560065

## Brief Description of the Innovation

**Stage of Development:** Proof-of-Concept

**Innovative element (s):** The novelty of the project lies in the integration of NOVEL MICROFLUIDICS AND OPTICS FOR AFFORDABILITY. We have finalized microfluidics design and currently optimizing optics and electronics aspects.

**Market potential:** The market potential is highly attractive considering its portability and projected affordability i.e. market rate

**Risk factor:** Timing to introduce the technology in the market poses the risk to the project

**National/ Societal Relevance:** Highly relevant considering this can be used broadly for immune health monitoring before Anti-retroviral therapy

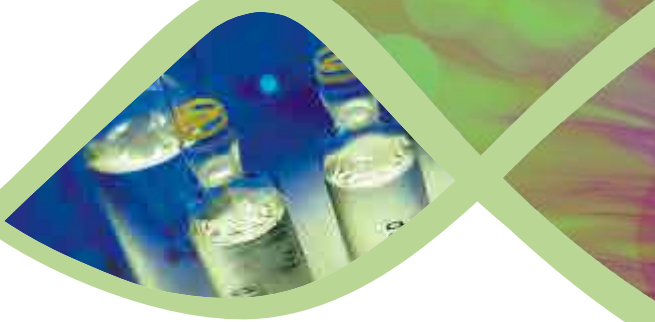
**Potential for IP generation:** Product design IP is already filed; PCT done in Feb 2013

## PERFORMANCE EVALUATORS

**Progress Quantifier:** The progress is as per projected timelines – we are at the final optics and electronics optimization.

**Plans to take the innovation further:** We plan to validate this at alpha and beta level after which we look to industry interest for TECHNOLOGY TRANSFER

**Level of Satisfaction:** 8/10



**Title of Innovation:** Development of Fast-PCR kit for detection of Tuberculosis  
[Funded under Scheme: BIPP]  
Collaborating Partners: None



**Team Members  
(including Collaborators)**  
Biswajit Roy  
V. S. Lakshmi  
Vandana Hegde

**Brief Description of the Innovation**

**Stage of Development:** Validation

**Innovative element(s):** FasTaq Polymerase, a mutant Taq polymerase, would complete Real-Time PCR-based detection of TB within 30 min (patent pending). A novel primer design technology to achieve 100% sensitivity and specificity (patent pending)

**Market potential:** High

**Risk Factor:** NA

**PERFORMANCE EVALUATORS**

**Progress Quantifier:** Validation nearing completion; on time

**Plans to take the innovation further:** Kits would be commercialized FY-2014

**Level of Satisfaction:** 7/10

**Address**  
Chromous Biotech Pvt. Ltd.  
#236, Pushpagiri Bhavan,  
'F' Block, Opp. Cauvery School,  
Sahakaranagar, Bengaluru-560092



**Title of Innovation:** "Production of Ranibizumab, a recombinant humanized Anti VEGF Monoclonal antibody fragment (recombinant huFab V2) expressed in Hansenula Polymorpha" [Funded under Scheme: BIPP]  
**Collaborating Partners:** None



#### Team Members (including Collaborators)

Dr. Sreenivasu Karra  
Mr. Muralidhar Reddy  
Mr. Vijay Babu Garlapalli  
Mr. Anil Kumar Challa

### Brief Description of the Innovation

**Stage of Development:** Discovery/Proof-of-Concept.

**Innovative element (s):** The screening of the best expression clone huFab V2-Hansenulapolymorpha. The recombinant humanized huFab V2 monoclonal antibody (heavy chain of 231 amino acids and light chain of 214 amino acids) DNA fragment was synthesized. The heavy chain and light chain DNA fragments are cloned (di-cistronic) into pFPMT-MFa and pFPMT Leu2 vectors. After clone confirmation, the DNA was transformed into KLA 8.1, Hansenulapolymorpha yeast strain and screened for best clone by PCR and Dot-blot. The clone was grown in YP-glycerol medium and induced by methanol for protein expression. The best huFab V2-Hansenula clone was selected after checking the secreted protein expression by SDS-PAGE, ELISA, Western blot. However, the expression levels were low and scale up experiments is on the way.

**Market potential:** Currently Genentech/ Novartis are the only company which is marketing Ranibizumab (Lucentis™) and there are no Indian players. With over few lakhs of new cases occurring each year due to this AMD disease in the country, there is a huge market potential.

**Risk factor:** The proper refolding and MFa-signal sequence processing of recombinant huFab V2 (heavy chain and light chain) before getting secreted into the medium. Production up to (0.5- 1.0 g/L of recombinant huFab V2) industrial scale

**National/ Societal Relevance:** The innovator of Ranibizumab is Genentech Inc., and the price is \$2340 per 0.5mg vial. The proposal is to make the product economically accessible to Indian patients at a lower price.

**Potential for IP generation:** The Genetech, Inc., has expressed Ranibizumab, recombinant huFab V2 in E. coli as secretory protein to periplasm. The expression using Hansenulapolymorpha, yeast (E.coli as alternate method) is novel. The protein is secreted into the medium and if expressed up to industrially scale has potential for IP generation.

### PERFORMANCE EVALUATORS

**Progress Quantifier:** Cloning of di-cistronic recombinant huFab V2 (heavy chain and light chain) into the pFPMT-MFa (URA+) and pFPMT-LEU2 Hansenula vectors. Screening of best expressing recombinant huFab V2-Hansenula polymorpha clone.

**Plans to take the innovation further:** To take recombinant huFab V2 protein expression to the industrial scale.

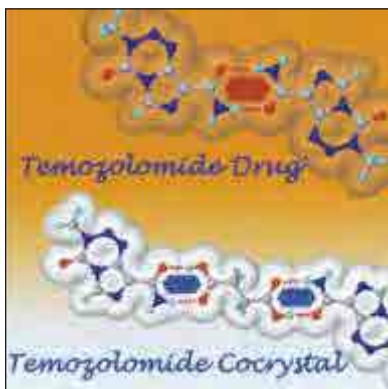
**Level of Satisfaction:** 6/10

#### Address

Clonz Bio Tech Private Limited  
Lab Suite # G9 & G10,  
Alexandria Innovation Centre,  
Plot 15 A, Alexandria Knowledge  
Park, Genome Valley, Shamirpet  
Mandal, R. R. District,  
Hyderabad-500078, (AP)



**Title of Innovation:** Clinical Trials of Novel Anticancer Drug Cocrystal [Funded under Scheme: BIPP]  
**Collaborating Partners:** National Institute of Nutrition, Hyderabad



**Team Members  
(including Collaborators)**

Dr. Ashwini Nangia  
Dr. Dinesh Kumar

**Address**

Crystalin Research Pvt Ltd  
Plot 81 A/C, Unit D, MLA Colony,  
Road No. 12, Banjara Hills,  
Hyderabad - 500 034

## Brief Description of the Innovation

**Stage of Development:** Validate the POC

**Innovative element (s):** The first example of a pharmaceutical cocrystal in pre-clinical investigation for anticancer drug in India. Pharmaceutical cocrystal with improved physico-chemical property and clinical efficacy for drug translation.

**Market potential:** Temozolomide is currently marketed by many companies in India.

**Risk factor:** The pre-clinical validation with BA/BE results will set the stage for human clinical study for Bioequivalence and Drug efficacy/ therapeutics improvement.

**National/ Societal Relevance:** A hydrolytically stable formulation of Temozolomide will be most relevant for tropical Zone IV region countries, e.g. India, Asia, South America, etc.

**Potential for IP generation:** Base patent on Temozolomidecocrystals is filed IN 2303/CHE/2009, and specific IP on TEMO-SUC will be submitted with pre-clinical data.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** Committed targets of making Temo-cocrystal and cell lines data and animal PK-PD, TOX are completed by the project completion date of 30 June 2013.

**Plans to take the innovation further:** After sharing data with PMC, plan to initiate Bioavailability study in human subjects of TEMO-SUC vs. Temo formulation.

**Level of Satisfaction:** 8/10

**Title of Innovation:** Design and development of a affordable Fluorescence Reader for Point-of care diagnostics [Funded under Scheme: BIPP]

**Collaborating Partners:** (i) ICGB, New Delhi (ii) Dept. of Biotechnology, University of Turku (Finland)



## Team Members (including Collaborators)

Dr. Dinesh Kumar  
Dr. Navin Khanna  
Prof. Kim Pettersson

## Brief Description of the Innovation

**Stage of Development:** Proof-of-concept, & Validation

**Innovative element (s):** The technology uses a novel up-converting phosphor technique as a detection system. It works on the principle of excitation of UCP nano-particle bound to a bio-molecule excited by low energy infrared laser, resulting in fluorescence in visible region, which is analysed by highly sensitive fluorescence reading instrumentation. The design of this instrument ensures no degradation and zero or no-auto fluorescence from biological samples, ensuring very high signal to noise ratios. This results in higher test sensitivity, thus, taking the sensitivity of ordinary immunoassays, closer to that of PCR range. This point-of-care technology has the potential to provide multiple diagnostic options in the future that can benefit the patients. It is suitable for various Point-of-care diagnostics using standard lateral flow cassette format and adaptable to various common diagnostic formats, ensuring an optimum design which is affordable & portable.

**Market potential:** This platform design has an immense potential for the point of care diagnostic applications, both in the developing and developed nations. The use of novel UCP technology and this instrument has the potential to remove the bottleneck of lower sensitivity associated with lateral flow or other format systems and can be adapted for inexpensive tests for detection of HIV, HCV, HBV, Syphilis and Tuberculosis infections.

**National/ Societal Relevance:** This affordable hand-held fluorescence reader will be of immense social value. It will help to detect multiple infections simultaneously in remote settings. One could imagine carrying out a pre-screening from a finger prick (Instead of post screening after collection of a bagful of blood) of blood donors for the presence of HIV, HCV, HBV and Syphilis infections. This will ensure less medical waste in blood banks. The use of up conversion phosphors developed by University of Turku, has the potential to enhance the sensitivity of these point-of-care multiplexed tests, to levels required by WHO.

**Potential for IP generation:** At present preparing the data for filing an IP (International patent.)

## PERFORMANCE EVALUATORS

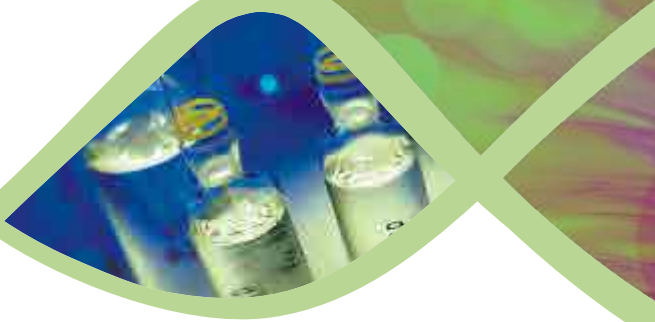
**Progress Quantifier:** Ability to quantify a single photon (Already accomplished)

**Plans to take the innovation further:** Industry led commercialization plans with Finland

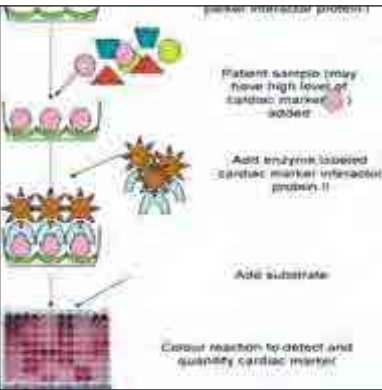
**Level of Satisfaction:** 9.5/10

## Address

Designinnova  
A-12, Naraina Industrial Area,  
Phase-I, Naraina Industrial Area  
New Delhi -110028



**Title of Innovation:** Development of Diagnostic Reagents for Acute Myocardial Infarction  
[Funded under Scheme: BIG]  
Collaborating Partners: None



**Team Members**  
Dr. Susmita Ghosh  
Dr. Sutapa Mitra

**Address**  
G. M. Biotech  
B2-10 Harmony Society,  
Nagras Road,  
Aundh, Pune- 411007

### Brief Description of the Innovation

**Stage of Development:** Proof –of–Concept

**Innovative element (s):** Finding protein interactors of cardiac markers and consequent use of those interactor proteins as diagnostic reagents

**Market potential:** This can replace present day closed systems for cardiac marker tests and can be marketed to small and medium sized pathological laboratories of urban and semi urban set ups.

**Risk factor:** Finding a pair of protein interactors whose binding efficiency can be utilized for diagnostics development itself is a risk.

**National/ Societal Relevance:** Successful isolation of right protein interactors may lead to development of cheaper and open systems cardiac marker ELISAs and card tests. Since most hospitals in India cannot afford expensive echo, Doppler and other cardiac imager instruments, these cardiac marker kits can help saving lives.

**Potential for IP generation:** New protein pairs which can together form a diagnostic reagent for a particular cardiac marker are potential candidates for IP generation.

### PERFORMANCE EVALUATORS

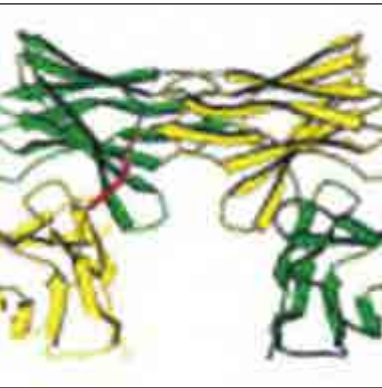
**Progress Quantifier:** We have started the project about six months back and we are progressing towards meeting our first milestone.

**Plans to take the innovation further:** Success of this project will motivate us to scale up, manufacturing and marketing.

**Level of Satisfaction:** 7/10



**Title of Innovation:** Expression of therapeutic diabody against TNF-alpha and IL-17R  
[Funded under Scheme: BIG]  
Collaborating Partners: None



**Team Member**  
Mr. Vikas Mehra  
Ms. Gauri Sanghvi

**Address**  
Genome Research Centre  
MSU Baroda,  
Sayajigunj Tilak Road,  
Vadodara - 390002

### Brief Description of the Innovation

**Stage of Development:** Discovery

**Innovative element (s):** Existing marketed therapies target only one cytokine/receptor & are majorly based against TNF $\alpha$ . Our novel molecule combines two antagonists, specific towards two different ligand/receptor. We assume our drug will be more potent, since the duration of treatment will be shorter, leading to fewer side effects.

**Market potential:** Our diabody can be used as a new agent for the treatment of psoriasis, the estimated global market for which is US\$ 3.5 billion.

**Risk factor:** Stability & shorter half-life of ScFv. However, we will devise methods by which we would be able to increase the half-life of our molecule.

**National/ Societal Relevance:** Psoriasis is an auto-immune disorder, which has a high prevalence in India. Our molecule is a simpler biologic, which can be produced by cheaper methods, as compared to expensive marketed biologics for psoriasis.

**Potential for IP generation:** Our diabody will be an innovative molecule, & we will be filing a provisional specification once we are able to obtain the diabody, which will take a couple of months.

### PERFORMANCE EVALUATORS

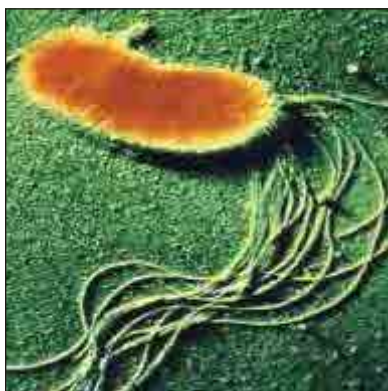
**Progress Quantifier:** We have successfully isolated anti-TNF $\alpha$  binders from our ScFv phage display library, which shows comparable ligand binding as with Humira (marketed anti-TNF drug). We have also done in-vitro assays to check activity in cell lines, & have got satisfactory data. We are now in the process of isolating anti-IL17R binders using the same platform, which has already yielded few potent binders.

**Plans to take the innovation further:** After the diabody is proven to be more efficacious, with good side effect profile, we will then license it out to an industry.

**Level of Satisfaction:** 7/10



**Title of Innovation:** Improved Recovery of Recombinant Interferon-beta During Downstream Processing by Addition of Charged Additives [Funded under Scheme: BIG]



## Team Members

### (including Collaborators)

Dr Durgaprasad Annavajjula  
Dr. Pramod Sutrave  
Lata Harish  
Dr. Rashbehari Tunga  
Satishbabu Guntupalli  
Rajanarendra Reddy  
Dr. Binita Tunga  
Dr. Anandlyer  
Dr. Anant Patkar  
Dr. Hank Talbot  
Dr Jeff Allen  
Dr Greg Cantin  
Dr. Ryan Haverstock

## Address

Inbiopro Solution Pvt. Ltd.  
#138-B, 2nd-3rd Floors,  
Udayagiri Complex, KIADB,  
Peenya 3rd Phase, Bangalore

## Brief Description of the Innovation

**Stage of Development:** Proof-of-Concept

**Innovative element(s):** The element of innovation is the use of a charged additive together with a detergent to reduce aggregation and improve the recovery of monomeric protein of interest to improve recovery and reduce COGS.

**Market Potential:** Cost of the goods (COGS) impacts the final drug product cost. IFN-  $\beta$ 1a is a therapeutic protein that currently used for treating MS and Hep C. The current market for the IFN-  $\beta$ 1a is about \$ 8 bn USD. Cost to patient is dictated by cost of goods COGS. Current processes using E.coli or CHO IFN- $\beta$ 1a) platforms result in low yield. Now, we are using the Pseudomonas fluorescens to express the IFN- $\beta$ 1a) at high levels (~8-12g/L). By improving the yield we can substantially reduce the COGs and ultimately cost to patient will be 5-6 fold lower.

**Risk factor:** Since these additives are already approved by various regulatory agencies for different applications, we don't anticipate any risks. In particular the additive that we are pursuing is considered as GRAS (generally recognized as safe) material hence there will not be any risk even if we are using as part of drug product.

**National/ societal Relevance:** The current molecule i.e., IFN-beta for which we are developing this procedure is going to be used mainly for treating multiple sclerosis patients. It is also applicable for treating Hepatitis C which is going to be more relevant for Indian Scenario. Based on the recent reports about 100 mil Indians are effected with Hep C and the treatment is anti-viral drugs in addition to IFN  $\alpha$  or PEGylated interferon  $\alpha$ . However, 50% of the people are not going to respond to the drug and that 50% can be treated with the IFN- $\beta$ 1a drug and this has been reported and approved in some of the regulatory countries. If we can bring the IFN- $\beta$ 1a drug to the market to treat Hep C at an affordable cost it is going to create a positive impact on the Indian society.

**Potential of IP generation:** In general, the purification of highly charged proteins, like IFN- $\beta$ 1a, consisting of many cysteine residues is very difficult because of its nature to aggregate. The novel process we have developed, is in our view, patentable subject matter as it overcomes critical issue of aggregation in protein purification. Although the additive has been known in the prior art, the use of this additive together with our modified downstream process is what has allowed us to recover high level of the protein thereby reducing the process steps and improving yield.

## PERFORMANCE EVALUTOR

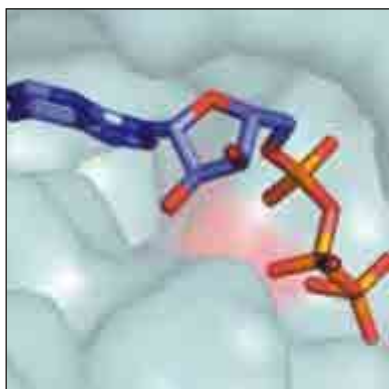
**Progress Quantifier:** We have generated the data with and without the presence of the additives and we obtained better recovery and also better purity in the presence of additives together with process modification. The data which we have generated shows almost 3 fold increase in the recovery with drug substance purity with one column in the presence of additive (>92%) with 2 columns similar to what was previously obtained. Furthermore, the improved yield and purity achieved with reduction in the number process steps resulted in improved DS recovery and reduced COGS.

**Plans to take the innovation further:** We are planning to take this process improvement further and use the same strategy even in the production scale so that the manufacturing cost will be lower; yields will be higher and with lower COGs.

**Level of Satisfaction:** 9/10



**Title of Innovation:** Discovery and development of Potent, Selective, and Novel c-Met kinase inhibitors in Cancer [Funded under Scheme: BIPP]  
Collaborating Partners: None



**Team Members  
(including Collaborators)**

Srikant Viswanadha  
Swaroop Vakkalanka  
Uday Kumar  
Prashant Bhavar

## Brief Description of the Innovation

**Stage of Development:** Proof-of-Concept

**Innovative element(s):** A series of novel scaffolds as c-Met kinase inhibitor have been designed, synthesized, and tested in enzyme and various cell-based assays. Lead compound has been identified based on in vitro, pharmacokinetic and efficacy data. Efficacy testing is complete and toxicological evaluation is currently in progress.

**Market Potential:** Among anticancer compounds the largest segment is of receptor tyrosine kinase inhibitors market was nearly \$9.4 billion in 2008; which increased to \$10 billion in 2009. This is expected to rise to \$13.1 billion in 2014, a compound annual growth rate of 5.5%.

**National/ societal Relevance:** With an enormously large population, there is a huge burden of cancer in India; thus drugs catering to cancer have an immense market potential.

**Risk factor:** Achieving differentiation from the advanced c-Met kinase inhibitors.

**Potential of IP generation:** PCT application has already been filed which is yet to be published.

## PERFORMANCE EVALUTOR

**Progress Quantifier:** Project is on track based on the projected time-lines

**Plans to take the innovation further:** We anticipate moving a lead compound to the clinic in 2014

**Level of Satisfaction:** 8/10

**Address**

Incozen Therapeutics Pvt. Ltd.  
450, Alexandria Knowledge Park,  
Phase-1, Turkapally, Shamirpet,  
Hyderabad- 500 078.



**Title of Innovation:** Generation of Prototype Lateral Flow Assay Kit using Antigen Specific Hybridoma to Develop Rapid Diagnostic Test for Clinical Diagnosis of Malaria. [Funded under Scheme: SBIRI]  
Collaborating Partners: Indian Institute of Science, Bangalore



## Team Members (including Collaborators)

Dr. R. Ramya  
Dr. M. Madhanmohan  
Dr. Arun Nagaraj

## Brief Description of the Innovation

**Stage of Development:** Discovery

**Innovative Element(s):** This project is intended to express the recombinant malaria antigens and generate species- and pan-specific MAbs. After evaluating with blood samples of malaria-infected patients, these MAbs would be utilized to develop RDT. Taking into consideration, the reported limitations associated with the detection of HRP2, LDH and Ald, the strategy to detect all the three antigens in a single test would provide better consistency and remain superior in terms of sensitivity, specificity and stability. Further, developing RDT using indigenous instead of imported MAbs would render cost-effective and affordable diagnosis in malaria-endemic regions.

**Market Potential:** In India the malaria diagnostic kits are being made with imported MAbs. An indigenous, simple to operate Lateral Flow Assay kit with MAbs against three different recombinant *P. falciparum* antigens is expected to have a wide market in India and other developing countries. While microscopic examination and PCR techniques require organized infrastructure and skilled technicians, RDTs based on the detection of parasite specific antigens by lateral flow immunochromatography are fast, easy to perform and interpret, and do not require technical expertise.

**National/ Societal Relevance:** Globally, malaria afflicts 300-500 million people and leads to over 1-2 million deaths. In India, *Plasmodium falciparum* and *P. vivax* infections remain predominant with at least one million malaria positive cases being reported annually. At present, parasitological diagnosis is carried out using microscopy, rapid diagnostic tests (RDTs) and polymerase chain reaction (PCR) based methods. Hence there is need for developing PLFA kit.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** Recombinant parasite antigens over-expressed in *E. coli* and purified using Ni-NTA Resin. the hybridomas were established and clones were screened against *E. coli* lysate, other his-tag proteins, RBC lysate, recombinant antigens and parasite lysate. Only those that are specific towards the recombinant antigens and parasite lysate were selected and subjected to the large scale affinity purification of IgGs. Also, the purified IgGs were biotinylated for pair selection. The first three milestones of this project with respect to the given timelines had been achieved and the progress that has been made so far is satisfactory.

**Plans to take innovation further:** At present, selection of IgG pairs for the three antigens has been carried out. After selecting the potential pairs by ELISA, gold conjugation will be carried out and LFA strips will be prepared with the different combinations. The strips will be validated with recombinant protein, parasite lysate and clinical samples.

**Level of Satisfaction:** 9/10

## Address

Indian Immunologicals Limited  
Road # 44, Jubilee Hills  
Hyderabad - 500033  
Andhra Pradesh

**Title of Innovation:** "Cost by Design: The role of advanced analytics in developing Affordable high quality therapies. [Funded under Scheme: BIPP]  
Collaborating Partners: None



## Team Members (including Collaborators)

Rishikant Gupta  
Prashant Shukla  
Chandrakant Patel  
Abhilash Menon  
Megha Modi  
Poonam Kapoor  
Hatim Motiwala  
Susobhan Das  
Himanshu Gadgil

## Brief Description of the Innovation

**Stage of Development:** Commercialization of first monoclonal of Intas with a brand name of MabTas®.

**Innovative element (s):** The product was developed using CQA based approach and implementing Quality-by-Design approach in manufacturing. This approach required high-end analytical capabilities all the way from clone development to commercialization as well as post-commercialization. The advanced analytical lab allowed us to determine primary, secondary and tertiary structures and associated CQAs of the protein. Novel techniques were developed using fluorometry Circular Dichroism, Differential Scanning Calorimetry and high-end mass spectrometry for characterization of therapeutic proteins. These novel technologies were applied to build quality into MabTas® from earlier stages of development. The approach used allowed us to make MabTas with highest quality and efficacy standards and a cost advantage which can be transferred back to the masses.

**Market potential:** The CQA/QbD based approach used in development of MabTas made product of premier quality with cost effectiveness to take to market. This approach shall be used for all the future development of monoclonal antibodies at Intas.

**National/ Societal Relevance:** The MabTas® developed is a highest quality and efficacy product available at a significantly reduced price than that of Innovator company. MabTas® is now available to large number of cancer patients in the country thereby increasing the survival of patients..

**Potential for IP generation:** The approach developed to commercialize MabTas, includes upstream cell culture process and high-end analytical methods usage is proprietary for the product.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** The establishment for the high-end analytical techniques for characterization of molecules is 50%.

**Plans to take the innovation further:** The approach and strategy designed for the development will be used for future molecules which Intas develops and also for support of protein characterization work to academic institutes as well as other biotechnology companies.

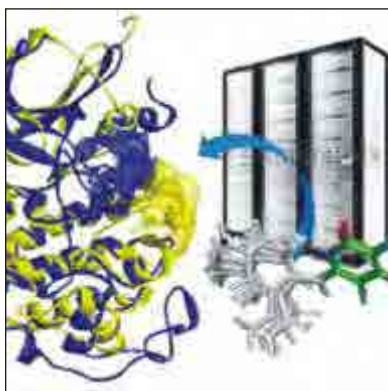
**Level of Satisfaction:** 9/10

## Address

Intas Pharmaceutical Limited  
Chinubhai Centre,  
Off. Nehru Bridge, Ashram Road,  
Ahmedabad - 380009. Gujarat



**Title of Innovation:** "Study, design and development of Hit Molecules for cancer targets". [Funded under Scheme: SBIRI]  
**Collaborating Partners:** (i) Department of Biotechnology, Bhupat and Jyoti Mehta School of Biosciences Building  
(ii) Indian Institute of Technology Madras, Chennai



#### Team Members (including Collaborators)

Praveen Agrawal  
Pankaj Sharma  
Prof. D. Karunakaran

#### Brief Description of the Innovation

**Stage of Development:** Presently the molecules are undergoing cell based studies. The program is in its proof-of-concept stage.

**Innovative element:** Developing novel, selective kinase inhibitors based on allosteric binding approach.

**Market Potential:** The program is targeting the market of resistant cancer therapy.

**Risk factor:** Since the program is in its earlier stages it has standard drug discovery related risk factors.

**National /Societal Relevance:** India has a huge cancer burden with a large percentage of cancer patients population resistant to current cancer therapy. Our methodology would open up unique treatment options for such patient population in India.

**Potential for IP Generation:** The molecules are unique and relevant patent around the outcome of the work would be filled.

#### PERFORMANCE EVALUATORS

**Progress Quantifier:** The milestones of design and chemical synthesis of the molecules have been successfully achieved. Presently the molecules are undergoing cell based studies.

**Plans to take the innovation further:** The focus of the program is to do the further improve the molecules based on the cell assay studies and subsequently do the in vivo testing.

**Level of Satisfaction:** High

#### Address

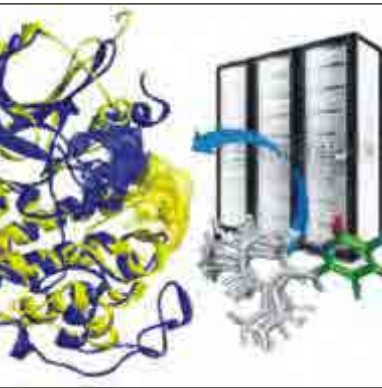
LeadInvent Technologies Pvt. Ltd.  
2nd Floor, Biotech Centre  
University of Delhi, South Campus  
Benito Juarez Road, New Delhi-21

# LeadInvent Technologies & Sphaera Pharma



Healthcare

**Title of Innovation:** Novel combination therapy for treatment of resistant and non-responsive cancers.  
[Funded under Scheme: BIPP]  
Collaborating Partners: (i) LeadInvent Technologies Pvt. Ltd. (ii) ICGEB



**Team Members  
(including Collaborators)**  
Dr. Pankaj Sharma  
Dr. Somdutta Sen  
Dr. Kanury Rao

## Brief Description of the Innovation

**Stage of Development:** Proof-of-Concept

**Innovative element (s):** The program uses a combination therapy that targets important synergistic proteins responsible for cancer.

**Market potential:** The program is targeting the market of resistant and non-responsive cancer therapy.

**Risk factor:** Since the program is in its earlier stages it has standard drug discovery related risk factors.

**National /Societal Relevance:** India has a huge cancer burden with a large percentage of cancer patient population are resistant and non-responsive current marketed therapies. Our methodology would open up unique treatment options for such patient population in India.

**Potential for IP Generation:** IP creation is the central core of this program and a series of patents is expected to be generated around the outcome of this work

## PERFORMANCE EVALUATORS

**Progress Quantifiers:** All the milestones have been successfully achieved.

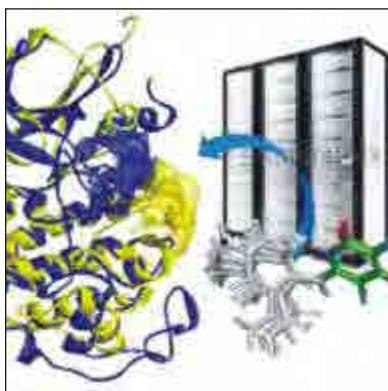
**Plans to take the innovation further:** The focus is currently on the next stage of the project with the aim to create a combination of compounds with clinical goals.

**Level of Satisfaction:** 9/10



**Title of Innovation:** "Using Peptidomimetics to design small molecules from a novel P1 peptide, for its interaction with beta amyloid oligomers by in-silico, in-vitro approaches and its efficiency in clearing beta amyloid load by ex-vivo model of Alzheimers disease"  
[Funded under Scheme: CRS]

**Collaborating Partners:** (i) Department of Microbiology, University of Delhi South Campus (ii) NBRC, Manesar



## Team Members (including Collaborators)

Pankaj Sharma  
Prof. Rani Gupta  
Dr. Ranjit K. Giri

## Brief Description of the Innovation

**Stage of Development:** Proof-of-concept

**Innovative element (s):** The program will be using peptidomimetics to design small molecules from a novel peptide.

**Market potential:** Presently there is no cure for actively progressing Alzheimer disease, therefore it has immense potential.

**Risk factor:** The program involves designing small molecule systems that mimic peptide therefore it has its challenges and standard drug discovery related risk factors.

**National/ Societal Relevance:** It is estimated that out of the total people suffering from Alzheimer 50% live in developing countries including India. Development of drugs for the treatment of Alzheimer disease would be of immense help.

**Potential for IP generation:** Since there are no therapies for actively progressing disease till date. Development of drugs to interfere with mis-folding and aggregation hold great promise and a series of patents is expected to be generated around the outcome of this work

## PERFORMANCE EVALUATORS

**Progress Quantifier:** We have identified number of peptides which interferers with multiple stages of beta amyloid oligomers and have achieved the first milestone successfully.

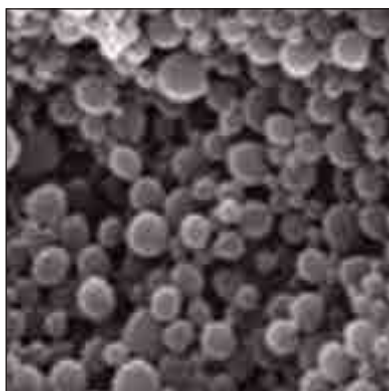
**Plans to take the innovation further:** The focus is currently on the next stage of the project with the aim to create small molecules to interferers with beta amyloid oligomers.

**Level of Satisfaction:** 5/10

## Address

LeadInvent Technologies Pvt. Ltd.  
2nd Floor, Biotech Centre  
University of Delhi, South Campus  
Benito Juarez Road, New Delhi-21

**Title of Innovation:** "Production of poly-(lactide-co-glycolide) nanoparticles (PLGA-NP) and poly-(lactide-co-glycolide) nanoparticles encapsulating anti-tubercular drugs (rifampicin, isoniazid and pyrazinamide) (PLGA-NP-ATDs) in GMP facilities". [Funded under Scheme: BIPP]  
Collaborating Partners: P.G.I.M.E.R., Chandigarh



## Team Members (including Collaborators)

Dr. Lily Verma  
Dr. Jitendra Nath Verma  
Prof. G.K. Khuller  
Dr. Nalini Vemuri  
Prof. Samir Malhotra  
Dr. Nusrat Shafiq

## Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative element (s):** A novel polymer-based nano-TB drug ( Nano DOTS RIPE-SR) is formulated for treatment of Mycobacterium tuberculosis infections, with the important objective of improving the existing chemotherapeutic regimen, by specifically reducing the dose frequency and thereby improving patient compliance.

**Market potential:** Being a superior alternative to current conventional drugs regime, the product would have huge demands both within and outside India

**Risk factor:** No risk foreseen in conducting Phase 1 trial with this formulation as both the molecules, anti-tubercular drugs (ATDs) as well as the polymer (PLGA) are approved by US-FDA for human use for several years. Preclinical studies have demonstrated their safety in animal models. Phase I clinical trial will be conducted in accordance with ICH-GCP (International Conference of Harmonization, Good Clinical practice) guidelines. Thus no risk is foreseen

**National/ Societal Relevance:** PLGA-NP-ATDs hold promise for effective control of TB and reversal of rising trend of MDR and XDR tuberculosis.

**Potential for IP generation:** Patent for the process has been granted (India) : Patent No : 239714. PCT filed in: Australia, Brazil, China, Europe, and USA. PCT granted in: Russia, S.Africa

## PERFORMANCE EVALUATORS

**Progress Quantifier:** Product Under Evaluation and Intervention Being Evaluated in house. PLGA-NP-ATDs will be prepared in GMP certified manufacturing unit. Prior to the clinical trial, quality assurance, preliminary pharmacokinetics and preliminary toxicology studies will be conducted.

**Plans to take the innovation further:** The GMP-product validation, in terms of pharmacokinetics and toxicology studies, would pave the way for Phase I clinical trial. The outcome of the Phase I clinical trial would be an indicator of the safety, bioequivalence and pharmacokinetics of PLGA-NP-ATDs and would thereby enable advancement to Phase II and /or Phase II trials.

**Level of Satisfaction:** 8/10

## Address

Lifecare Innovations Pvt. Ltd  
B-589, Sushant Lok Phase - I,  
Gurgaon - 122 002, Haryana



**Title of Innovation:** Hi-Fidelity Affordable Mannequin for Effective CPR (Cardiopulmonary Resuscitation) Training. [Funded under Scheme: BIPP]  
Collaborating Partners: IIT-Madras



#### Team Members

Dr M. Manivannan  
Mr Varun Durai S. I.

#### Brief Description of the Innovation

**Stage of Development:** Discovery and Proof-of-Concept.

**Innovative element:** Cardio Pulmonary Resuscitation (CPR) is a life-saving skill. Cardiovascular diseases have reached epidemic proportions in our country, with a corresponding rise in cardiac arrests. It is imperative to train the general, non-medical public in performing CPR to prevent brain damage from the delay in securing medical intervention after a cardiac arrest. The human chest has a non-linear compliance, i.e., at the start of compression, the chest appears to yield easily but as the compression depth increases, the stiffness increases, resisting our efforts to compress the chest by 4.5 cm. Our mannequin, used for training CPR skills, has non-linear technology to simulate this behavior of the human chest. Ours is the only commercially available mannequin globally to simulate non-linear behaviour. The human chest compliance varies widely from person to person depending on their muscularity, girth, age etc; our mannequin is equipped with multiple sets of non-linear technology to simulate for CPR training with a wide variety of chest compliance. Realization of the exact skill needed for CPR training, that is compression depth of 5cm (for Adult) and also how to train the hand-eye coordination with minimum resources possible, is the main innovative element of this project in our company. The research output is the design of our CPR mannequin.

**Market Potential:** We aim to reach all the corporate offices, IT offices, colleges (NSS and NCC cadres), schools.

**Risk Factor:** There is no scientific evidence that non-linear simulator is better than linear simulators for training CPR skills. This is exactly where BIPP funding is helping our company to verify the efficacy of our non-linear simulation technology.

**National/ Social Relevance:** None of CPR mannequins are made in India and also none of the mannequins are customized for Indian population- all the mannequins are imported mostly from US. Know-how of this technology has not yet reached India. Our CPR mannequin is to fill this gap, for the first time in India. We aim to reach all the colleges and higher secondary schools in India, which we think easily trainable than the adults. Also, the social clubs such as elderly homes could be trained.

**Potential for IP generation:** CPR Mannequin with Non-linear Chest Stiffness and CPR Mannequin with tuneable rescue breathing technology.

#### Address

Merkel Haptic System Pvt. Ltd.  
MSB 356, IIT Madras,  
Chennai - 600036, Tamil Nadu



**Title of Innovation:** Development of novel intensified Technology platform for production of low cost MAb. [Funded under Scheme: BIPP]



**Team Members**  
Dr. Rajyashri K. R  
VinayKonaje  
Ujwal Kumar J

### Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative element (s):** Novel media/supplements for growth and sustenance of high density animal cell cultures. Novel method for capturing the antibodies/fusion protein that would bypass the centrifugation and microfiltration steps presently required for MAb

**Market potential:** USD 1.3-1.5 billion pa market for bioprocess technology platforms. We hope to capture atleast 10% of this market.

**Risk factor:** Possibility of lowered per cell productivity per cell at high densities leading to no overall significant reduction in cost of manufacture of MAb

### PERFORMANCE EVALUATORS

**Progress Quantifier:** HD fermentation process being validated presently with 2-3 MAb.

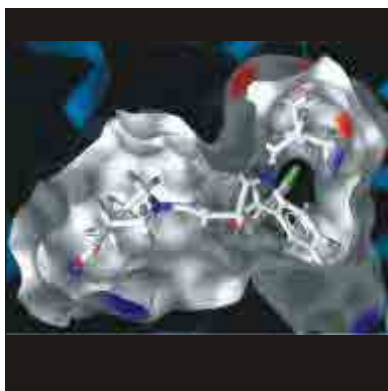
**Plans to take the innovation further:** Setup of a plant for manufacture of MAb based on the above mentioned technologies; reduce overall cost of production of MAb by appx 40%

**Level of Satisfaction:** 9/10

**Address**  
Navya Biologicals Pvt. Ltd  
NavDisha, STEP Building,  
BVBCET, Vidyanagar, Hubli- 580031



**Title of Innovation:** Study, Design & Development of Hit Molecules for Type II Diabetes. [Funded under Scheme: BIG]  
**Collaborating Partners:** (i) School of Biological Sciences (ii) Super Computing Facility for Bioinformatics & Computational Biology, IITD



#### Team Members

Avinash Mishra  
Sahil Kapoor  
Rahul Singh  
Tanya Singh  
Poonam Saini  
Dr. B. Jayaram  
Dr. Chinmoy Shanker Dey

## Brief Description of the Innovation

**Stage of Product Development:** Project is presently under Discovery phase. Focusing on insulin resistance pathway with a strategy of suppressing two proteins involved in Type II Diabetes

**Innovative element(s):** Innovative element involves multiple selection & optimization of fragments, descriptors from in house compound library specifically designed for kinases. Another innovative element involves hand-to-hand customized experimental validations for optimizing compounds at different levels.

**Market Potential:** Diabetes holds a strong global market. Present drugs in market pose a serious side affect which in turns open market for less toxic & novel small molecules.

**Risk factor:** It involves at stage where compounds might not show better efficacy. To mitigate risk, we initiated project with two different targets with two sets of compounds at different functional level.

**National/ Societal Relevance:** Diabetes accounts for 60% of death every year. According To Diabetologia, 2011, risk of patients would touch 552 million globally.

**Potential for IP generation:** Discovery of small molecule at this stage would open boundaries for new IP.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** Once compounds show good efficacy, patents will be filed and immediately next stage will proceed for lead optimization for developing drug candidates.

**Plans to take innovation further:** Experimental studies for compounds are presently in process for first target. Simultaneously, computational research on second target is initiated.

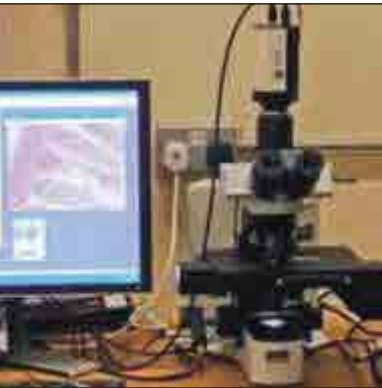
**Level of Satisfaction:** 7/10

#### Address

Novo Informatics Pvt. Ltd.  
TBIU, 2nd Floor, Synergy Building  
Indian Institute of Technology,  
Hauz Khas, New Delhi - 110016



**Title of Innovation:** Oncoscan - Digital Oncopathology Slide Scanner [Funded under Scheme: BIPP]  
**Collaborating partners:** None



**Team Member  
(including Collaborators)**  
Dr. Gauri Gholap

### Brief Description of the Innovation

**Stage of Development:** Validation & Commercialization.

**Innovative element(s):** OncoScan, a Hardware Instrument, will offer Ease of operations, Scalability, Security and Integration with software for Image viewing and Management, at affordable costs. Images will be Reliable, Accurate, Objective and Reproducible. With Adaptable Software Solutions for Analysis of Images (say PAP smear), it will offer a complete Digital Pathology Solution.

**National Societal Relevance:** OncoScan will facilitate early disease diagnosis and prevention. It will open feasibility of effective connection to remote rural areas, in addition to referral centres in cities, making quality healthcare accessible and affordable to one and all, at virtually no risks.

**Potential for IP generation:** Being first of its kind in India, potential for IP is tremendous.

### PERFORMANCE EVALUATORS

**Progress Quantifier:** Application Development is at the advanced stage of completion. The Proposed Automated Whole Slide Scanner is a successful innovation. Based on initial trials, it is expected to generate high resolution digital images from pathology glass slides and probably ahead of its schedule

**Plans to take the innovation further:** Concurrent to testing Quality and other parameters, there would be usual iterations to ensure consistent reliable output. On successful launch, endeavour will be developing scalable Software for analysis of Images for deployment in tandem.

**Level of Satisfaction:** 7/10

**Address**  
Optra Systems Private Limited  
503, B Wing, Manikchand  
IKON, Dhole Patil Road,  
Pune - 411001



**Title of Innovation:** Development of safe and highly efficacious 13 – valent pneumococcal conjugate vaccine against streptococcus pneumoniae infections. [Funded under Scheme: BIPP]  
Collaborating Partners: None



#### Team Members (including Collaborators)

Dr. Sudhakar konda  
Dr. Harish chandra  
Dr. Pradeep gupta  
Divya Garga  
Meenu Jain  
Kumar Gaurav

### Brief Description of the Innovation

**Stage of Development:** The project is currently in the stage of Proof-of concept/validation.

**Innovative element(s):** Our conjugation process is unique and resulting in high recoveries thus lowering the cost of product. Company is committed to provide the vaccine at affordable cost.

**Market Potential:** The vaccine has market potential of 930 cr with least risk due to high gap in supply and demand.

**National/ Societal Relevance:** The vaccine is required as the pathogen has been estimated to cause ~16 million deaths every year, including up to one million in children below 5 years of age. The cases are highest in developing countries and the vaccine has the potential to reduce the burden of disease.

**Potential for IP generation:** The process developed has some unique aspects in fermentation, downstream and conjugation process and are being considered for patents.

### PERFORMANCE EVALUATORS

**Progress Quantifiers:** The development of vaccine is in advanced progress. For all the selected serotypes, the cell banks were prepared and characterized. The upstream and downstream process for polysaccharide as well as carrier protein was developed at small scale and scaled up to 15-L. The characterization of purified capsular polysaccharides as well as carrier protein was carried out as per WHO/EP guidelines. Proof-of-concept for conjugation process to covalently link carrier protein with polysaccharide was also established. Immunogenicity studies in animals exhibited good immune response with most of the monovalent conjugate tested.

**Plans to take the innovation further:** In future, the scale-up of the process, formulation, drug product formation will be carried out.

**Level of Satisfaction:** 10/10

#### Address

Panacea Biotech Ltd  
B-1 Extn./ A-27,  
Mohan Co-op. Industrial Estate,  
Mathura Road, New Delhi -110044

**Title of Innovation:** Development of Novel Peptide Based Topical Gel for the Treatment of Alopecia.

[Funded under Scheme: BIPP]

Collaborating Partners: None



**Team Members  
(including Collaborators)**

Dr. Sanjay Trehan  
Dr. Sudhakar Konda  
Dr. Vijay Goel  
Rahul Jain

## Brief Description of the Innovation

**Stage of Development:** Validation and Commercialization

**Innovative element (s):** The final outcome of the proposed study will be an effective and safe topical gel for treatment of alopecia. The success of the project will have great financial impact as well as landmark achievement in this area.

**Market potential:** >1 billion \$ globally

**Risk factor:** quantitative estimation of new hair follicles in animal studies, stability of gel formulation, exact duration of application of topical gel formulation, toxicity of the formulation

**National/ Societal Relevance:** Alopecia is a problem that affects millions of men and women in India and across the world. Millions of dollars and considerable time is being invested in research for finding a solution to this problem. Several hair growth remedies have been marketed. However, available remedies based on rigorous scientific proof are only a few. Hence There is a need for development of new hair growth medicine/ formulation for treatment of alopecia..

**Potential for IP generation:** This is a project in licensed from NIH USA. There is possibility of IPR for appropriate formulation and scale-up process.

## PERFORMANCE EVALUATORS

### Progress Quantifier

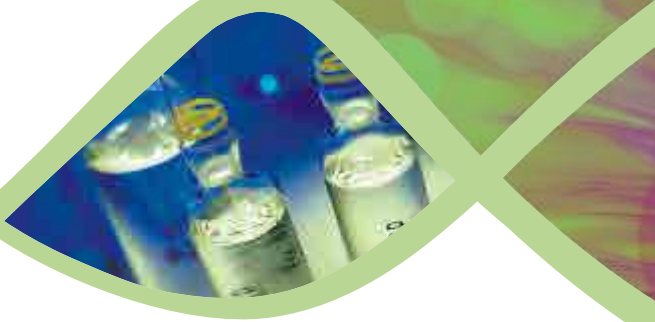
- Method developed for scale-up synthesis of peptide
- Three trial scale-up batches synthesized with optimized process
- Developed a method for scale-up purification of peptide by HPLC
- Analytical Method developed and validated for peptide API
- Specifications of Peptide API developed
- Gel Formulations developed for final product

**Plans to take the innovation further:** Stability Study of API and formulation are in progress. Efficacy experiments will be carried out with developed gel formulations after initial stability studies

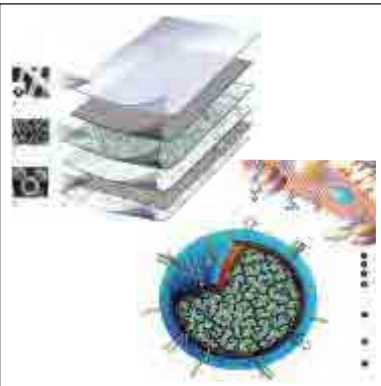
**Level of Satisfaction:** 10/10.

## Address

Panacea Biotech Ltd  
B-1 Extn./ A-27,  
Mohan Co-op. Industrial Estate,  
Mathura Road, New Delhi -110044



**Title of Innovation:** Modular Resilin Mimetic Elastomeric Platform. [Funded under Scheme: BIG]  
**Collaborating Partners:** None



**Team Members  
(including Collaborators)**  
Dr. Tuhin Bhowmick  
R. Arun Chandru

**Brief Description of the Innovation**

**Stage of development:** PTPL is at the stage of discovery to proof-of-concept

**Innovative Element(s):** At Pandorum Technologies Pvt. Ltd. (PTPL), we have developed a rationale to design and synthesize an advanced class of bio-inspired elastomers, by studying the macromolecular structure of naturally occurring elastomeric proteins, known to form various extra cellular matrices in our tissues. It essentially exploits the self-assembly properties of bio-inspired molecular building blocks to form modular bio-mimetic viscoelastic hydrogels. Such hydrogels can be further loaded with drug molecules, functionalized to be responsive, and fabricated in various forms.

**Market Potential:** Our scientific framework using bio-inspired modular building blocks enables us to engineer a 'class' of materials with broad range of properties and applicability, and mitigates various risks associated with development and commercialization of novel biomaterials.

**National/ Societal Relevance:** Our focus application areas are: 'smart' delivery systems for various classes of lifesaving drugs, and mechanically demanding tissue engineering scaffolds; wherein there are big gaps between socio-economic needs and available affordable technological solutions.

**Potential of IP generation:** The novel class of bio-inspired hydrogels, with tunable properties would form the basis to generate valuable intellectual properties in the field of advanced bio-materials.

**PERFORMANCE EVALUATORS**

**Progress Quantifier:** With the support of Biotechnology Ignition Grant, PTPL is in the process of development and optimization via molecular simulations, fabricating representative prototypes, validating relevant material properties and securing IP. At present, PTPL is essentially material-centric.

**Plan to take innovation further:** Post BIG, PTPL intends to further develop and validate its core platform technology via close collaboration with prospect academic and industry partners, in the following priority application areas: 1) optically transparent elastomeric tissue engineering scaffold for corneal endothelial 2) resilient elastomeric hydrogel for facet resurfacing, and 3) responsive drug delivery micro/nano-systems targeted for oncological applications.

**Level of satisfaction:** 8/10

**Address**  
Pandorum Technologies Pvt. Ltd.  
No. 157 Basaveshwara Temple  
Street, Cholanayakanahalli.  
R T Nagar Post, Bangalore

**Title of Innovation:** SanGeniX: A comprehensive Next Generation Sequence (NGS) data Analysis solution. [Funded under Scheme: BIPP]  
**Collaborating Partners:** (i) Indian Institute of Science and Educational Research (IISER), Pune (ii) Indian Institute of Technology (IIT), Mumbai (iii) National Bureau of Animal Genetic Resources, Karnal (Haryana)



## Team Members (including Collaborators)

Akshay Yadav  
Abhay Jere  
Vivek Kulkarni  
Anamika Krishanpal  
Gauri Kale  
Heena Bargir  
Kapil Kulkarni  
Neha Sharma  
Nikhil Bora  
Pallavi Dawkhari  
Prajakta Pujari  
Rajesh Mahato  
Shivangi Walvekar  
Shraddha Wani  
Varsha Kadam  
Yogini Joshi  
Sanjeev Galande  
Ramesh Kumar Viji

## Address

Persistent Systems Limited  
Bhageerath, 402,  
Senapati Bapat Road,  
Pune - 411016

## Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative elements:** SanGeniX is a comprehensive, automated, scalable and user friendly NGS data analysis suite with a robust genome assembly feature. We have tested and validated all the tools, framework, and workflow engine. SanGeniX will be offered as a standalone, server and cloud based solution to address a wide range of bioinformatics need. Using SanGeniX, we will be generating a complete draft of the Indian water buffalo (Bubalus bubalis) genome following de novo assembly and annotation.

**Market Potential:** It will have broad applicability and can be used for genomic analysis of any organism (animal, plant, microbes etc.).

**National/ Societal Relevance:** Globally and in India as well, major research institutions and Biopharmaceutical companies are rapidly adopting NGS technology for human, animal and plant research. The broadest application of NGS is in re-sequencing of human genomes to enhance our understanding of genetic differences in health and diseases.

**Risk Factor:** there are some risk factors which are: availability of few open source tools; NGS technology evolving rapidly.

**Potential of IP generation:** SanGeniX will be the first tool developed in India to offer assembly of genome in the form of an integrated package. Using SanGeniX, we plan to offer NGS data analysis services to researchers with no bioinformatics resources.

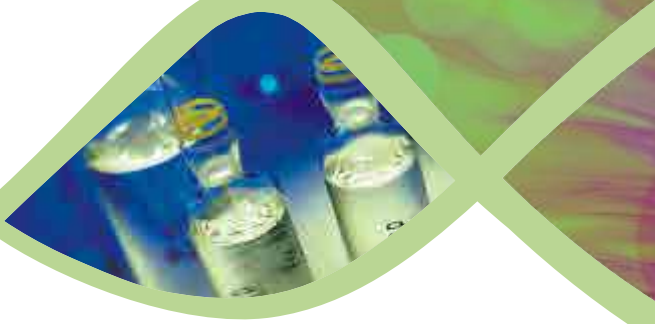
## PERFORMANCE EVALUATORS

### Progress Quantifier

- Building SanGeniX: 0-30 months: Evaluation of tools, detailed analysis of the features, design and development, documentation, development of backend architecture, Integration of optimized tools and algorithms.
- Testing SanGeniX: 12-30 months: Alpha testing, Bug fixing, beta testing at user's site, finalizing hardware requirement.
- Development of assembly algorithm: 0-36 months: Assembly method development and testing, Integration of algorithm, manuscript describing the assembly methodology

**Plans to take the innovation further:** SanGeniX will be made available in two versions; SanGeniX-Titanium, a desktop version for computationally less intensive analysis and SanGeniX-Platinum, a cluster version for computation intensive high-end data analysis. Developing SanGeniX on cloud;

**Level of Satisfaction:** 9/10



**Title of Innovation:** A natural product derived oral hypoglycemic formulation, PM2040, to control and prevent progression of pre-diabetes patients to Type-2 diabetes. [Funded under Scheme: SBIRI]  
**Collaborating Partners:** (i) JSS Medical College, Mysore, Karnataka (ii) Sadvaidyasala Pvt. Ltd, Nanjangud, Karnataka



**Team Members**  
VenSubbiah  
Aiyappa Palecanda  
Suresha R. N.  
Rajesh Srinivasan

### Brief Description of the Innovation

**Stage of Development:** Proof of Concept

**Innovative element (s):** An Ayurvedic formulation that has a standardized production process with chemical identity for reproducibility backed by animal efficacy and safety data.

**Market potential:** Globally there are 346 million people suffering from Type 2 diabetes and is estimated to reach 430 million by 2030. In 2011, India had 62.4 million people with Type 2 diabetes which is predicated to reach 100 million by 2030 (Nature, 2012, 485-S-14). Due to the sheer numbers, the economic burden due to diabetes in India is amongst the highest in the world. Our product is targeted to this market.

**Risk factor:** Based on initial data and analysis there is no risk in bringing this product to market. The only issue we face is timely funding to reach that goal.

**National/ Societal Relevance:** The societal relevance of this proposal is the direct possibility of improving the quality of life of pre-diabetic patients and the halting the progression to diabetes.

**Potential for IP generation:** We have applied for an Indian Patent for the manufacture and use of this product as an alternative hypoglycemic supplement worldwide.

### PERFORMANCE EVALUATORS

**Progress Quantifier:** A standardized QC'd production process, animal efficacy data and animal toxicity profile.

**Plans to take the innovation further:** Our goal is to conduct extended toxicity studies followed by a proof of principle clinical trial. We will be approaching BIRAC to fund this critical phase prior to marketing the product.

**Level of Satisfaction:** 7/10

**Address**  
PhytoMyco Research Pvt. Ltd.  
43 KIADB Industrial Area  
Nanjangud -571 302,  
Mysore District, Karnataka State



**Title of Innovation:** Fetal Electrocardiogram and Uterine Activity signal extraction from Maternal Electrocardiogram eliminating the need for the use conventional Transducers. [Funded under Scheme: BIG]  
Collaborating Partners: None



#### Team Members (including Collaborators)

Dr. Dinesh Bindiganavale  
Dr. Prakash Sonwalkar  
Dr. B R Shamanna

### Brief Description of the Innovation

**Stage of Development:** Proof of concept

**Innovative element (s):** Conventional ultrasound transducers for fetal heart rate & pressure transducer for uterine activity monitoring is replaced by application of separating algorithms on abdominal ECG acquired from the mother. The vital signals of the fetus are embedded within the mother's abdominal ECG. This new technique reduces the overall product cost by >30% eliminating the need for transducers while enhancing the device performance. As a result the user interface & workflow becomes simple for the care giver to setup monitoring before & during labor very easily. It also provides significantly higher comfort for the expecting mother as there are no heavy transducers strapped around the abdomen.

**Market potential:** By virtue of reduced product cost, easy workflow & value added features the feasibility of deploying the new product in primary care centers, smaller towns & remote monitoring addresses the unmet need that hitherto was lacking from the conventional fetal monitors because of cost & complexity in usage.

**Risk factor:** The technical risks related to performance & device operation inherent in the conventional fetal monitors presently in the market is largely mitigated in this new technology.

**National/ Societal Relevance:** The present penetration of conventional fetal monitors is restricted to large hospitals & urban locations largely due to cost & its complexity. The unmet need to improve infant & maternal mortality rate is addressed by this proposed new device that will not only be economical, user friendly but is targeted to penetrate primary care markets & provide value added objective data that will directly have a bearing on improving the maternal child care statistics. It also provides an opportunity for remote monitoring which could potentially increase the coverage and improve the maternal child care statistics.

**Potential for IP generation:** The versatility of the separation algorithms, presentation & interpretation of data & user interface are the potential areas that have opportunity to create new IPs.

### PERFORMANCE EVALUATORS

**Progress Quantifier:** The project is being tracked over four well defined milestones with each milestone deliverables showcasing progress. The project flow follows the ISO 13485 & FDA QSIT checklist versions broadly to adhere to regulations as well as good design practices. Program & technical risks are being monitored closely to provide course corrections if required.

**Plans to take the innovation further:** Feature & technology upgrades to the proposed project deliverables is factored into a 3 year roadmap to add value to the 1st variant resulting from this project.

**Level of Satisfaction:** 5/10

#### Address

Pradin Technologies Pvt. Limited  
J101, Mantri Woodlands,  
Bannerghatta Road,  
Arekere, Bangalore - 560076

**Title of Innovation:** Evaluation of Platinum Nano Particles for the Treatment of Hormone Refractory Prostate Cancer. [Funded under Scheme: BIPP]  
Collaborating Partners: None



#### Team Members (including Collaborators)

Dr Yogesh Bendale  
Dr. Vineeta Bendale  
Sunil Bhonsle  
Dr. Soumya Bhattacharya  
Dr Saili Bhattacharya  
Surendra Nagre  
NandineeKhot  
Dr. Sandhya Bhabal and  
Dr. Rammesh Natu

#### Address

Rasayani Biologics Pvt. Ltd  
48/7, Mahlunge-Nande Road,  
Mahlunge, Taluka Mulshi,  
Pune - 411045

## Brief Description of the Innovation

**Stage of Development:** Proof of concept.

**Innovation element(s):** The innovation is to develop biologically effective Platinum product for treatment of hormone refractory Prostate cancer. To develop and test Anticancer intervention based on platinum chemistry in bot, in vitro and in vivo models for anti-cancer application. Bioplatin is proposed to be fed orally and is the first home grown active pharmaceutical intervention. The innovation can be effective for all primary tumors, surgically operated and targeting for prevention of metastasis (prophylaxis).

**Market potential:** All metastatic tumors treatment market in India and overseas. The current cost of extending life for 1 year of 550 thousand American cancer patients is \$440 billion. With the burgeoning cancer cases there exists a market potential of \$7 billion in India for the indicative and palliative treatment at the reduced costs.

**Risk factor:** The time frame required for Regulatory approvals is quite big.

**National/ Societal Relevance:** Bioplatin, proposed for the management of malignancies, is an oral, platinum based metallic complex with well tolerated side effect profile produced by novel environmental friendly process using herbs. Product is of high social relevance in our country for treatment of cancer as it will also help increase life and help to improve the quality of life of cancer patients.

**Potential for IP generation:** Patents obtained in India, US and EU. It has a potentially novel mechanistic action. It does not work through conventional cytotoxic approach. And It provides preliminary evidence of its therapeutic and prophylactic potential

## PERMONACEVALUTORS

**Progress Quantifier:** We have undertaken animal toxicity studies as per the norms of Schedule Y. It was observed that mechanism of action of Bioplatin is considerably innovative than conventional platinum drugs. It is not cytotoxic in action. The effects were studied on cancer and normal cell lines to differentiate the effect.

**Plans to take the innovation further:** Phase- I trials shall be conducted at a speciality oncology research centre in India. To conduct Phase-II with Platinum sensitive tumors based on preclinical and Phase I data like Prostate Cancer – HRPC etc.

**Level of Satisfaction:** 4/10



**Title of Innovation:** Development of a tissue engineered graft using autologous chondrocyte for cartilage repair. [Funded under Scheme: SBIRI]  
**Collaborating Partners:** None



**Team members (including collaborators)**  
Dr. Deepa Ghosh  
Dr. Chandra Viswanathan

### Brief Description of the Innovation

**Stage of Development:** validation

**Innovative element(s):** Cartilage damage is being currently treated worldwide with chondrocyte cell suspension implanted under a periosteal flap. Here the limitations' including cell loss, and need for surgical collection of periosteal flap. These limitations can be overcome by implanting the cells attached to a scaffold. Our product consists of cells cultured on a biocompatible and biodegradable scaffold without using a periosteal flap. It may be implanted by arthroscopy.

**Market Potential:** Since the prevalence of cartilage damage in India is very high, this product is expected to have a high market potential.

**National/ Societal Relevance:** The product has to be tested in clinical trials.

**Potential of IP generation:** First tissue engineered graft developed clinically for treating cartilage damage.

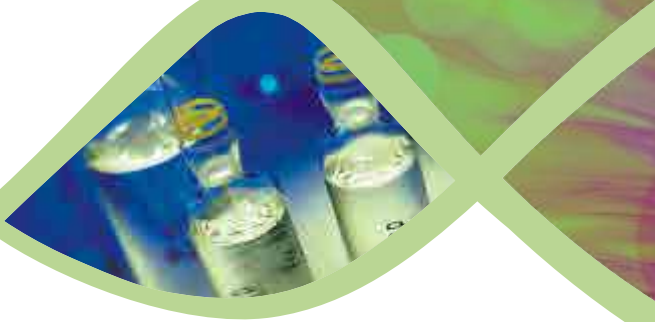
### PERFORMANCE EVALUATORS

**Progress Quantifier:** Product was evaluated and approved by CBBTDEC committee. A formal approval by DCGL is awaited

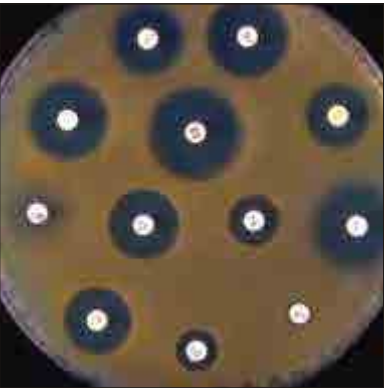
**Plans to take the innovation further:** After clinical evaluation the product would be available for patients.

**Level of Satisfaction:** Delay in clinical trial approval has set back the progress by three years.

**Address**  
Reliance Life Sciences Pvt. Ltd  
Dhirubhai Ambani Life Sciences  
Center, R-282, TTC Industrial Area  
of MIDC, Thane-Belapur Road,  
Rabale, Navi Mumbai - 400 701



**Title of Innovation:** A Platform for Rapid Antibiotic Susceptibility Testing and Assessment of Bacterial Load [Funded under Scheme: BIG]



**Team Members**

Udit Parekh  
Wilson D'Souza  
Anand Sivaraman  
Preethi Vaddi  
Venkatachalapathy V.  
Sowmya Ramaiah

**Brief Description of the Innovation**

**Stage of Development:** Developing a proof-of-concept product by integrating full functionality into a microfluidic chip and developing a compact, automated, portable reader to output results.

**Innovative element (s):** Sabio is developing a rapid antibiotic susceptibility and bacterial load testing platform which aims to deliver susceptibility results within 6 hours from sample collection thus enabling prescription of treatment after testing.

**Market Potential:** The combination of ease-of-use, high sensitivity, portability and affordability makes this a highly novel device with the potential of huge societal and market impact.

**National/ Societal Relevance:** One of the major problems facing modern medicine today is the development of drug-resistance in bacteria. To determine the correct treatment, it is critical to verify that the pathogen is bacterial and perform an antibiotic susceptibility test. Today, culture and susceptibility tests take at least 48 hours, by which time the treatment is usually started, empirically. This creates a huge public health impact by promoting faster build-up of resistance due to antibiotic abuse. This is especially so in India, where the reflex prescription of antibiotics is highly prevalent due to wide availability of inexpensive generic drugs, lack of access to diagnostics and high turn-around time of traditional tests.

**Potential of IP generation:** We have developed a patent-pending method which determines cell growth or death at the single cell level instead of changes in bulk phenomena like turbidity which take a much longer time to detect and require a much larger number of cells to perform.

**PERFORMANCE EVALUATORS**

**Progress Quantifier:** We have completed validating our proposed antibiotic susceptibility testing method on 30 clinical samples of E. coli, using 10 antibiotics commonly used to treat urinary tract infections with >90% agreement with reference gold standard, which meets performance requirements mandated by regulatory bodies. We are currently developing an assay to assess the bacterial load in urine samples while also developing a chip to integrate the functionality of the susceptibility test and a reader to output results.

**Plan to take innovation further:** Once the proof of concept is complete, we plan to productise and commercialise this innovation, and bring it to market.

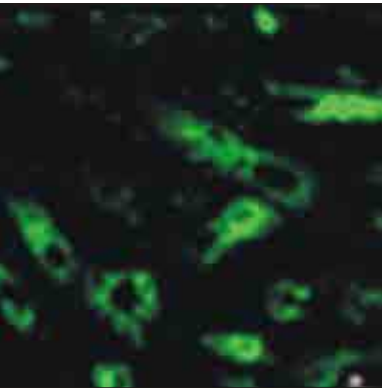
**Level of Satisfaction:** 8/10

**Address**

Sabio Innovative Solutions Pvt Ltd  
#3045, Prestige Kensington  
Gardens, 17 HMT Main Road,  
Bangalore- 560013



**Title of Innovation:** Novel Oncolytic Measles Virus using the eSAME technology.  
[Funded under Scheme: BIG]



**Team Members  
(including Collaborators)**  
Vasanti Amrutkar  
Shailendra Rane  
Vishwas Joshi

**Address**  
Seagull BioSolutions Pvt. Ltd.  
L- 5, Lab Block, NCL Innovation  
Park, No. 100, Dr Homi Bhabha  
Road, Pune - 411 008

### Brief Description of the Innovation

**Stage of Development:** Proof of concept

**Innovative elements:** The eSAME system provides a simpler method of producing rec. Measles Virus (rMV) which has emerged as a versatile vector for production of new vaccines & therapeutic agents. This project will employ the eSAME technology to produce an oncolytic and immunopotentiatingrMV which will be more effective than other currently used oncotherapeutic MV.

**Market Potential:** Marketing success of virotherapeutic agents like RIGVIR (Europe), Gendicin (China) and anticipated approval of viral therapies like Oncovex (Amgen) has opened a new market segment that can grow at a CAGR of 68%.

**National/ Societal Relevance:** The eSAME is possibly the first Indian technology that will empower Indian vaccine Industry - which is the largest producer of Measles vaccine worldwide -to enter this new emerging market segment.

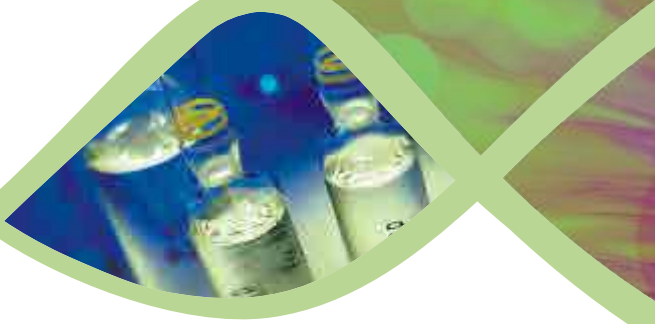
**Potential of IP generation:** We have developed proprietary (PCT/IN2012/000405) technology for production of recombinant Viral Vaccines & viro therapeutic agents.

### PERFORMANCE EVALUATORS

**Progress Quantifier:** (1) Production of target virus; (2) In vitro demonstration of oncolytic activity and(3) In vivo demonstration of oncolytic & immune potentiating activity

**Plans to take the innovation further:** (1) large scale production; (2) Preclinical development & (3) Phase I Clinical study, (4) Out licensing

**Level of Satisfaction:** 8/10



**Title of Innovation:** Silk protein blend film for wound management, standardization of production process, clinical evaluation, value enhancement and concept establishment (Phase –II). [Funded under Scheme: SBIRI]  
**Collaborating Partners:** None



**Team Members  
(including Collaborators)**  
Mr. Bharat Tandon  
Dr. P. M. Radhakrishna  
Dr. M. Vidya

**Brief Description of the Innovation**

**Stage of Development:** validation/commercialization stage

**Innovative element (s):** The intended product (FibroHeal) is a bilaminate film, having least water absorption from the surface exposed to atmosphere when it is covered on the wound and moderate absorption from the surface in contact with the wound. The surface in contact with the wound also exhibit antimicrobial properties and help in acceleration of epithelial regeneration in terms of enhanced growth rate of fibroblast and keratinocyte cells. The novel actives are activated silk matrix and asiaticoside (from Centella asiatica). Silk Protein is similar to collagen in its nature and also in enhancing fibroblast and keratinocyte cell growth.

**Market potential:** Bioengineered products are competing in a worldwide market and in which improvements in quality of life and treatment outcomes continue to be top healthcare. Increase in number of burn injury incidence especially in rural and semi urban areas, Requirements of healing of auto graft wounds and Increase in the number of diabetic wounds are further creating the market demand.

**Risk factor:** Based on the data available on preclinical and clinical Phase II trials no risk factor was observed using FibroHeal. However the same will be monitored during multi-centric trials.

**National/ Societal Relevance:** In rural and semi-urban areas of India large scale burn injuries are getting reported. There is huge number of foot ulcers getting reported especially from diabetic patients too belonging to weaker section of the society?

**Potential for IP generation:** Patent awarded vide: Indian Patent No: 245840

**PERFORMANCE EVALUATORS**

**Progress Quantifier:** Based on the data available, FibroHeal is performing well in terms of reduction in the number of wound healing days, reduction in the percentage of the wound size and scar formation.

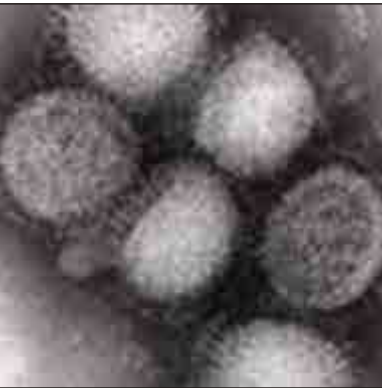
**Plans to take the innovation further:** The utility of Silk protein with other active ingredients and probe synergistic actions will be done.

**Level of Satisfaction:** 8/10

**Address**  
Sericare, A Division of  
Heathline Pvt. Ltd  
IS-21 KHB Industrial area,  
Yelahanka New Town,  
Bangalore-Karnataka - 560064



**Title of Innovation:** Humanized neutralizing monoclonal antibody against the 2009 pandemic H1N1 influenza virus.  
[Funded under Scheme: BIPP]  
Collaborating Partners: (i) National Institute of Immunology, New Delhi (ii) Indian Institute of Science, Bangalore, India



**Team Members  
(including Collaborators)**  
Dr. Rajeev Dhere  
Dr. Leena Yeolekar  
Dr. Satish Kumar Gupta  
Dr. Raghavan Varadarajan  
Nachiket Shembekar  
Vamsee V Aditya Mallajosyula

**Address**  
Serum Institute of India Limited  
212/2, Hadapsar,  
Off Soli Poonawalla Road,  
Pune - 411028

## Brief Description of the Innovation

**Stage of Development:** Proof-of-Concept

**Innovative element(s):** To the best of our knowledge, this is the first report of a humanized neutralizing antibody against the H1N1 virus, especially the 2009 H1N1 virus. The proposal is for generation, humanization and expression of high affinity monoclonal antibodies (MAbs) for potential therapeutic use in humans

**Risk Factor:** The high specificity of this humanized antibody and its production cost can be the only limiting factors in this project.

**Market Potential:** Considering the more than 50 billion dollar industry of the therapeutic antibodies, these antibodies will definitely have great market value.

**Potential of IP generation:** An Indian patent for the murine MAb has been filed (3799/DEL/2011).

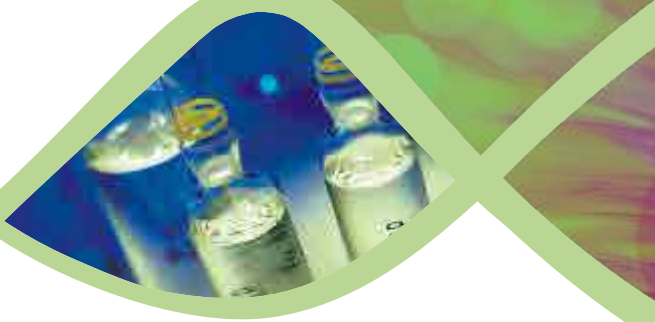
**National/ Societal Relevance:** The pandemic H1N1 virus, since its emergence in 2009, has caused more than 5 million infections with about 2,00,000 deaths worldwide. In this project, we explored the possibility of generating MAbs against the 2009 H1N1 virus, which could be useful for diagnosis as well as therapeutic application.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** We isolated one of the high affinity, murine MAb potentially neutralizing the 2009 pandemic H1N1 influenza virus, reported so far. The studies also revealed that the nanogram detection sensitivity of the antibody could be useful as diagnostic reagent

**Plans to take the innovation further:** The humanization strategy that we have used can be applied to generate therapeutically relevant antibodies against the other infectious diseases, autoimmune disorders and cancer.

**Level of Satisfaction:** 8/10



**Title of Innovation:** Development of HPV Vaccine. [Funded under Scheme: BIPP]  
**Collaborating Partners:** None



**Team Members (including Collaborators)**  
Mr. Umesh Shaligram  
Dr. Janowicz  
Mr. Harish Rao  
Dr. Carsten Ameul

**Brief Description of the Innovation**

**Stage of Development:** Preclinical development

**Innovative element(s):** Generic

**Market Potential:** 50 to 100 Million Doses per annum for developing countries

**Potential of IP generation:** An Indian patent for the murine MAb has been filed (3799/DEL/2011).

**Risk Factor:** Conviction and acceptability of the vaccine among the targeted population.

**National/ Societal Relevance:** The use of the vaccine as a part of the immunization program can bring down the cases of cervical cancer significantly.

**Potential for IP generation:** Generic vaccine, hence only Process IP is envisaged

**PERFORMANCE EVALUATORS**

**Plans to take the innovation further:** Additional antigens along with novel adjuvants and immune stimulators are planned.

**Level of Satisfaction:** 8/10

**Address**  
Serum Institute of India Limited  
212/2, Hadapsar,  
Off Soli Poonawalla Road,  
Pune - 411028



**Title of Innovation:** Intraosseous Access Device. [Funded under Scheme: BIG]  
**Collaborating Partners:** None



**Team Members  
(including Collaborators)**  
Jayant S. Karve  
Dr. Sandeep Singh

**Address**  
Stanford India Biodesign  
All India Institute of Medical  
Sciences, Ansari Nagar,  
New Delhi - 110029

## Brief Description of the Innovation

**Stage of Development:** Proof-of-concept and validation

**Innovative Element(S):** The team has developed a novel, simple, disposable and affordable device which can be deployed in resource-constrained environment. The manually operated device has superior insertion ability to penetrate the bone in less than 10 seconds. The fluids and medications are infused directly into the marrow. The device is usable even by paramedics with minimal training.

**Market Potential:** An estimated 1.3 million patients per year in India are deprived of an alternative to IV access leading to substantial morbidity and mortality which could otherwise be prevented. Presently, no devices are available in India for intraosseous (IO) access, though the American Heart Association (AHA) recommends it as the first alternative to IV access in cardiac arrest patients.

**National/Societal Relevance:** Establishing access to the circulation is a critical component of resuscitation in emergency patients. Even though peripheral access (through the veins in the arm, for example) is the preferred mode, many a time it is difficult to access these veins. This can happen in patients with cardiac arrest, trauma or obstetric emergencies. In such patients, blood volume and pressure in the body are low, which leads to collapsed veins. Precious time is lost in trying to gain intravenous (IV) access during this “golden period” of patient care. Hence, the proposed device has relevance.

**Potential of IP generation:** This is patent pending invention.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** At present, the IO device is successfully tested in human cadavers at All India Institute of Medical Sciences, New Delhi. To achieve this functional testing the prototypes were built and refined with multiple iterations in design. The team has finalized the injection moulding device and intends to complete the FIH.

**Plan to take innovation further:** The results of the cadaveric study were submitted to ethics committee and approval for first in human (FIH) studies is granted.

**Level of Satisfaction:** 9/10

**Title of Innovation:** Establishment of Bioprocess Facility for Large-scale Production of Microbial Antigens and Monoclonal Antibodies under cGMP Conditions. [Funded under Scheme: BIPP]  
**Collaborating Partners:** None



**Team Members  
(including Collaborators)**

Dr. Pradip K. Desai  
Mr. Veeral Desai  
Mr. Paras Desai  
Dr. Udaikumar Padigel  
Mr. Rahul Khakhra

**Address**

Span Diagnostics Limited  
173-B, New Industrial Estate,  
Road No. 6-G Udhna,  
Surat - 394 210, Gujarat

## Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative element (s):** Unique first of its kind facility (run by private company) that would meet captive need of the company and support researchers from Universities/Institutions. It will train biotech professional to combat shortages of skilled personnel and support SME and small Industries by providing contract manufacturing

**Market potential:** Expected development and manufacturing of quality immunodiagnostic kits and reagents of global standards at more economical rate which will increase demand and bring in foreign exchange.

**Risk factor:** Negligible as expertises are available

**National/ Societal Relevance:** Import substitution for critical raw material and self-reliance

### PERFORMANCE EVALUATORS

**Progress Quantifier:** The cGMP-compliant bioprocess facility is established within the premises of Span Diagnostics Limited (SDL), Surat with BIPP support for large-scale production of high quality critical raw materials indigenously for manufacturing immunodiagnostic devices of global standard indigenously and thereby ensuring import substitution advantage and self-reliance. The BSL-1 laboratories of the facility is established on an area of about 1561 sqft and is fully functional and being utilized for indigenous production of monoclonal antibodies of anti-sera for blood grouping. The BSL-2 and BSL-3 laboratories of the facility are constructed on an area of about 4160 sqft and have now been commissioned.

**Plans to take the innovation further:** various clones for diagnostically important monoclonal antibodies and recombinant antigens are purchased by company, which will now utilized

**Level of Satisfaction:** 9/10



**Title of Innovation:** Manufacturing and Commercialization of a Low Cost and Reliable Clinical Chemistry Analyzer [Funded under Scheme: SBIRI]

Collaborating Partners: None



#### Team Members (including Collaborators)

Ms. Sujata Desai  
Mr. Pranav Naik  
Mr. Kajal Kumar Ghosh  
Mr. Deepak Thanekar  
Mr. Hemal Naik  
Mr. Nimesh Karia  
Mr. Kaushik Khorasiya  
Mr. Ashok Parmar  
Mr. Navin Patel  
Mr. Ankit Naik  
Mr. Pritesh Patel  
Mr. Ankur Naik  
Mr. Vimal Naik  
Mr. Bhagu bhai Patel

#### Address

Span Diagnostics Limited  
173-B, New Industrial Estate,  
Road No. 6-G Udhna,  
Surat - 394 210, Gujarat

#### Brief Description of the Innovation

**Stage of Development:** Commercialization

**Innovative element (s):** Fault tolerant design, Robust to withstand large power fluctuations, User friendly and Service friendly design

**Market potential:** 1800 units in India and 8000 units in the world per year

**Risk factor:** Unstable economy, decrease in investment in capital items, entry of cheaper products

**National/ Societal Relevance:** In India, similar products are imported and marketed/serviced by local companies. Span Diagnostics Ltd is one of rare companies who have ventured in instrumentation development and scaling up for production. The developed product will improve the reach of healthcare facilities in India. Additionally, the product will help in early diagnosis thereby decreasing the overall expenditure on healthcare. The product will not only reduce imports but will also generate foreign currency by exports.

#### PERFORMANCE EVALUATORS

**Progress Quantifier:** Manufacturing the device

**Plans to take the innovation further:** Already plan to make newer products based on the developed innovation.

**Level of Satisfaction:** 9/10



**Title of Innovation:** A parallel group randomized open blinded endpoint evaluation, multicentre, dose escalation, phase – II study assessing the safety and efficacy of intra-arterial (Hepatic) ex-vivo cultured adult Allogeneic Mesenchymal stem cells in patients with Alcoholic Liver Cirrhosis. [Funded under Scheme: BIPP]

Collaborating Partners : None



## Team Members (including Collaborators)

Dr. Pawan Gupta

Dr. Anish S Majumdar

Dr. Anoop

## Brief Description of the Innovation

**Stage of Development:** Proof-of-concept and Validation

**Innovative element(s):** Stempeutics has the technology to upscale the bone marrow derived allogeneic mesenchymal stem cells derived from few donors and produce stem cell product (stempeucel) sufficient for 10000+ patients. Stem cells can be developed as an off-the-shelf cryopreserved product which can be infused into the patients as and when required. This technology will enable us to bring down the cost of stem cell therapy. Human mesenchymal stem cells are being used in cases of end-stage liver disorders to prevent further degeneration of hepatocytes through their immunomodulatory properties that turn off allogeneic T cell activation and chronic inflammatory process through paracrine activity.

**Market Potential:** An early as well as safe intervention is needed to restore or salvage the normal functions of the liver. The standard treatment for advanced decompensated liver cirrhosis is Orthotopic Liver Transplantation (OLT). However, potential benefits are hampered by many drawbacks such as relative shortage of donors, operative risk, post-transplant rejection, recidivism of the pre-existing liver disease, high cost and several complications.

**Risk Factor:** There is a potential risk in this type of novel stem cell technology based clinical trial as this may not have drastic impact on the progression of the disease process. However, it is noteworthy that our ongoing phase II clinical trials using allogeneic MSCs (stempeucel) in critical limb ischemia and osteoarthritis have shown that MSCs are safe and may likely to be efficacious.

**National/ Societal Relevance:** Alcoholic cirrhosis develops in 15% of individuals who drink heavily for more than a decade. Prevalence of alcoholics in India is found to be 21% in adult males. This ranges from as low as 7% in western state of Gujarat to 75% in northeastern part of the country. The standard treatments available do not offer a cure for the disease. Adult stem cell therapy may offer a cure or regression of the disease for such group of patients. This study is planned to cater the unmet needs in liver cirrhosis.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** Till date the product seems to be safe with no major safety concerns and the project is progressing satisfactorily. The progress of the project is being monitored by recruitment of eligible patients into the trial. It is expected that the last patient first visit will be completed by March 2014. Thereafter, these patients will be followed up for 6 months and study report will be generated and the same will be shared with BIRAC. The study is progressing as planned and it is expected to finish the 60 patient's recruitment by Mar 2014.

**Plans to take the innovation further:** If the product is safe and shows positive trend in efficacy, we plan to apply for conducting phase III clinical trial in this indication. Stempeutics is aiming to be the pioneer in the field of stem cells in India once the ongoing phase II clinical trial is successful.

**Level of Satisfaction:** 8/10

## Address

Stempeutics Research Pvt. Ltd.  
Akshay Tech Park #72 & 73, 2nd  
Floor, EPIP Zone, Phase 1,  
Whitefield, Bangalore – 560066



**Title of Innovation:** Hepatotoxicity Prediction Platform. [Funded under Scheme: BIPP]

**Collaborating Partners:** None



**Team Members  
(including Collaborators)**

Dr. Kalyanasundaram Subramanian  
Dr. Sonali Das

**Address**

Strand Life Sciences Pvt. Ltd,  
5th Floor, Kirloskar Business Park  
Bellary Road, Hebbal,  
Bangalore - 560024

## Brief Description of the Innovation

**Stage of Development:** Validation/Commercialization

**Innovative element (s):** We have developed a novel systems approach to model pathways in the liver and combined it with in vitro measurements to create a detailed predictive platform that is capable of providing insight into Drug Induced Liver Injury (DILI). This will help in replacing or reducing animal usage, and increase efficiency of drug development by predicting hepatotoxicity. Our platform can not only help predict hepatotoxicity in the liver, but can be extended to organs such as the kidney and heart, to predict nephrotoxicity and effect of diet on cardio vascular diseases respectively.

Our inventive step has been the integration of our in silico liver physiology model with in vitro assays, that can validate the in silico model. This model can combine many facets of toxic pathways to the chemical structure in a systematic manner, to provide detailed mechanistic rationale for toxicity as well as potential biomarkers for detection. Our predictive modeling approach models normal liver function or homeostasis. The model includes both constituent information (proteins and enzymes) as well as detailed kinetic information, i.e., rate constants of the various reactions, rate laws and flux information and is patent-protected.

**Market potential:** Pharmaceutical and FMCG companies invest millions of dollars every year to develop drugs. However, only a few drugs qualify for clinical trials and enter the market. At times, drugs are subject to post-marketing withdrawal due to their toxicity. This leads to significant loss of effort and capital for pharmaceutical companies. To minimize such losses, we propose our platform for pursuing research on hepatotoxicity or toxicity in general, using which companies can efficiently advance their drugs through the pipeline at a lower cost. The market potential for mechanistic toxicology testing is expected to be USD 720M in 2013 and grow at 15 percentage per year.

**Risk factor:** The approach does not predict all the possible manifestations of hepatotoxicity with equal efficiency which reduces its effectiveness.

**National/ Societal Relevance:** Affordability of research infrastructure to assess the toxicity of drugs is a major impediment for drug discovery in India and other developing countries. Our platform will significantly bring down the costs associated with toxicity research.

**Potential for IP generation:** The background IP generated has two parts – a systems model (in silico) of the liver called the Virtual Liver. Both these concepts, the in silico model and associated assays have been protected by a patent – Subramanian et. al. Method for Predicting Organ Toxicity and a System Thereof. New IP in terms of additional assays, model tuning, and a method from metabolomics to predict toxicity as well as a kit and a protocol will possibly be generated from the project. All of the above will be independently protected.

### PERFORMANCE EVALUATORS

**Progress Quantifier:** We have started applying this technology in a few pharma organizations. Progress will be determined if we can able to be a routine part of the pharma R&D process at most of the major organizations.

**Plans to take the innovation further:** We will continue to evolve both the modeling as well as the assays. We would like to offer the assays in a high throughput mode and add newer assays to enrich the platform.

**Level of Satisfaction:** 9/10



**Title of Innovation:** Diabetic Wound Healing Agent wound healing efficacy of novel formulation SLS-03: Pre-clinical studies. [Funded under Scheme: SBIRI]  
Collaborating Partners: None



#### Team Members (including Collaborators)

C. Damodar Reddy  
Naga Raju  
Kodandarami Reddy  
Dattatreya Rao  
D. Narapa Reddy

#### Brief Description of the Innovation

**Stage of Development:** Proof-of-concept

**Innovative element (s):** Simple inexpensive Herbal agent for curing complicated chronic Diabetic Foot Ulcers (DFU). The agent is effective in chronic, complicated DFU where all other treatments have failed. Preclinical efficacy and safety studies completed for a herbal formulation that was shown to be effective in Indian System of Medicine, Ayurveda practitioners: Need to do clinical trials with commercial batches: Production optimization and formulation development related activities are needed

**Market potential:** Very high. There is unmet need for effective treatments for DFU in many rural / semiurban areas of India

**Risk factor:** Low: Safe, effective, inexpensive

**National/ Societal Relevance:** National importance, High Diabetes, Peripheral neuropathy leading to almost 20% of DFU in Diabetic population in rural areas

**Potential for IP generation:** High; Unique manufacturing process and combination of common herbs. Negotiating with other companies for commercialization.

#### PERFORMANCE EVALUATORS

**Progress Quantifier:** The preclinical data completed and limited clinical trial data indicates non-toxic nature, safety and excellent clinical outcome in human clinical trials

**Plans to take the innovation further:** Yes, GMP production, Formulation Development, Licensing/ commercialization. Few investors have shown interest in completing formulation development gaps, and testing commercial batches in human clinical trials

**Level of Satisfaction:** 8/10

#### Address

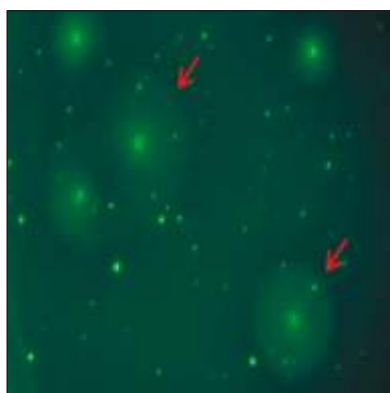
Sugen Life Sciences Pvt Ltd,  
4 / 86 SV Nagar Perumallapalli  
Tirupati - 517505,  
Andhra Pradesh



**Title of Innovation:** Development of Biosimilar “Bevacizumab” to bring to the affordable Zone.

[Funded under Scheme: BIPP]

Collaborating Partners: None



#### Team Members

Dr. Sanjay Singh  
Dr. Santosh Pokalwar  
Dr. Pradeep Mishra  
Mr. Sudharti Gupta  
Mr. Nitinnage  
Mr. Rajat Ghosh

#### Brief Description of the Innovation

**Stage of Development:** The preliminary characteristics of the cell line have been studied. The lab scale process is developed for the production of the product. The Tumor regression Efficacy of the product is studied in in-vivo condition. The physico-chemical and biological characterization of the product have been studied. The Bio-similarity studies with reference to the innovator's product have been studied.

**Market Potential:** The sale of the product in 2012 was \$6.260 billion in 2012. The product recorded a very impressive sales growth in last 5 years. The Product has the potential to grow in the near future.

**Risk factor:** Making the product Biosimilar to the reference drug in terms of Physico-chemical, Biological, PK / PD, Immunogenicity.

**National / Societal Relevance:** Presently the treatment is too expensive to afford by the common mass. We are trying to develop the product which could be cost effective and affordable by the common mass.

**Potential for IP Generation:** The cell line is developed using the Proprietary expression vector of Sun Pharma.

#### PERFORMANCE EVALUATORS

**Progress Quantifier:** Cell Line developed. Small scale process developed. The product was found physico-chemically and biologically comparable to the Innovator's product. Process-scale up to be done. Animal safety to be established. PK/PD and immunogenicity to be studied

**Plans to take the innovation further:** Scale-up followed by safety studies and clinical studies.

**Level of Satisfaction:** 8/10

#### Address

Sun Pharmaceutical Industries Ltd.  
Acme Plaza, Andheri,  
Kurla Rd Andheri (E),  
Mumbai - 400 059

**Title of Innovation:** Scientific validation of Bronco T: a polyherbal formulation for bronchial asthma in experimental models (Phase-I)" [Funded under Scheme: SBIRI]  
Collaborating Partners: None



## Team Members (including Collaborators)

Dr. Vachaspati Tripathi  
Mr. Manglesh Kumar  
Mr. C. B Tripathi  
Mr. Arun Kumar

## Address

Surya Pharmaceuticals  
1596 First Floor, Bhagirath Place,  
Chandni Chowk,  
Delhi – 110006

## Brief Description of the Innovation

**Stage of Development:** Discovery and Proof-of-Concept

**Innovative element(s):** There is no such safe product in the market for treatment of Bronchial asthma, upon validation it will be a unique product in the market.

**Market Potential:** As the product is unique, and safe there will not be competition in marketing. The product is already in market with clinically proven therapeutics so there is no risk rather the validation will open a global market

**National/ Societal Relevance:** As the product is unique effective and based on pure herbal ingredients, the raw material is herbal which will bring socioeconomic uplift man in the villages and forest.

**Potential of IP generation:** Finally after validation and also affective molecule identification shall open the door of patent right.

## PERFORMANCE EVALUATORS

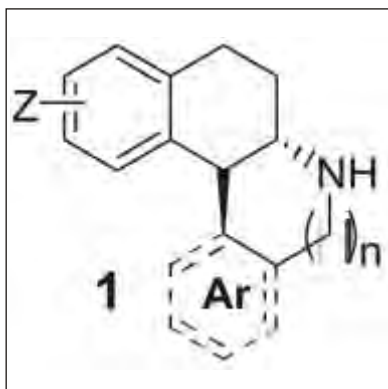
**Progress Quantifier:** Phytochemical evaluation and standardization of single ingredient and complete formulation. Mechanism proving and safety and toxicity study

**Plan to take innovation further:** Clinical trial and effective molecule identification and pharmacodynamic study

**Level of Satisfaction:** 9/10



**Title of Innovation:** Process for Asymmetric Synthesis of Hexa hydro benzophenanthrene Dopamine D1 Agonists. [Funded under Scheme: BIPP]  
Collaborating Partners: IIT Kharagpur



## Team Members (including Collaborators)

Sourav Basu  
Saumen Hajra  
Rajib Ghosh  
TusharKanti Dey  
Sagar Chakraborty  
Amit Ghosh  
Swarup Dutta  
Shantanu Dutta

## Brief Description of the Innovation

**Stage of Development:** Discovery and Proof-of-Concept

**Innovative Element(s):** Hexahydrobenzophenanthrene class of compounds (and its homologue  $n=2$ ) 1 such as dihydrexidine, A-86929 or ABT-431 are known as full dopamine D1 agonists for Parkinson's, cognition and other CNS disorders. Development of cost-effective concise process for the stereoselective synthesis of hexahydrobenzophenanthrenes in optically pure form was considered to be an important objective.

**Market potential:** Large scale asymmetric synthesis of this class of compounds in a cost effective way is in process.

**Risk Factor:** some of these compounds might not come to market post development if assessed with potential risks and target liabilities.

**National/ Societal Relevance:** The drug is meant for Parkinson's, cognition and other CNS disorders

**Potential of IP generation:** The work done at TCGLS has generated high quality publications.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** The team is continuing some work on asymmetric catalysis method developed under these schemes which are published.

**Plan to take innovation further:** Certain modifications of the published method will make the process more scalable.

**Level of Satisfaction:** 5/10

## Address

TCG Lifesciences Ltd.  
Block BN, Plot 7 Salt Lake  
Electronics Complex Sector V,  
Kolkata - 700091, West Bengal

**Title of Innovation:** Development of an Affordable, Asia specific 15 valent Pneumococcal Polysaccharide - CRM 197 Protein Conjugate Vaccine. [Funded under Scheme: BIPP]  
**Collaborating Partners:** None



## Team Members (including Collaborators)

Dr. M. Kuppusamy  
Mr. Muthukrishnan  
Mr. Ravindran  
Mr. Kannan

## Address

Tergene Biotech Private Limited  
Plot No: 34, Tulsi Gardens,  
JJ Nagar PO, Yaprak, Secunderabad - 500087, (AP)

## Brief Description of the Innovation

**Stage of Development:** Validation:

**Innovative element(s):** Technology developed for a commercially viable CRM 197 production and for an affordable PCV. Cost effective production of CRM 197. Cost effective production of Polysaccharides. Highly efficient conjugation protocol. Affordable, India specific Vaccine formulation.

**Market potential:** Pneumonia is the most common form of serious pneumococcal disease and accounts for 18 % of child deaths in developing countries, making it one of the leading causes of death among young children. GAVI Alliance's Strategic Demand Forecast during 2012 has indicated that by 2015, potential global demand of pneumococcal vaccine will approximately be 120 million doses, increasing to nearly 210 million doses by 2020, and peaking at just over 220 million doses by 2030. Annually India witnesses 45 million pneumonia cases among children under 5 years of which 370,000 die due to the disease. There is a huge open market in India itself as 26 million children born in India every year and vaccine schedule will target children between 2 months to 59 months. This translates to 78 Million doses every year, considering the population above 1 year is vaccinated. If we take the cost of each dose as USD 7.5 According to Pneumo ADIP report, the estimated public vaccine price is at US\$ 5 and \$10 dose for the Low and Middle income countries, the total annual cost burden will be USD 585 Million.

**Risk factor:** The life cycle of bacterial vaccines are very high, exceeding 50 years as proved in the existing bacterial vaccines. However, there are possibilities of Protein antigens being developed as alternate vaccine candidates.

**National/Societal Relevance:** Increasing incidence of streptococcal infection in the young and elderly and wide spread antimicrobial resistance (AMR) and diversity in the serotype distribution necessitate the need for the development of an Asia specific, indigenous and cost effective vaccine for *S. Pneumoniae*. According to WHO, Pneumonia kills an estimated 1.6 million children every year worldwide, 25% in India alone – more than AIDS, malaria and tuberculosis combined. International Vaccine Access Centre Report Nov 2010 says India is witnessing the highest number of pneumonia-related child deaths in the world. The infection is killing 16 lakh children under five every year, more than 3.7 lakh in India alone. At present, there are no local manufacturing capabilities and the vaccine is imported.

**Potential for IP Generation:** Production technology of CRM 197 and the conjugation protocol are unique and merits patenting.

## PERFORMANCE EVALUATORS

**Progress Quantifiers:** The proof of concept developed during phase 1 was further extended to trial production, conjugation and formulation of 15-valent Pneumococcal Conjugate Vaccine (PCV). Manufacturing process is validated in terms of scale-up and reproducibility. The final vaccine meets all the requirements of European Pharmacopeia. The immunogenicity of the trial vaccine was conducted in mice model in comparison with a reference vaccine (13-valent) which is already approved in India. The antibody titer of the test vaccine was very much comparable to the reference vaccine. The two additional serotypes included in the 15-valent PCV exhibited an antibody titer comparable to other serotypes present in the reference vaccine.

**Plan(s) to take the innovation further:** Production of GMP grade Polysaccharide and CRM. Formulate the final vaccine and conduct stability studies. Conduct pre-clinical studies. Phase II & III clinical trials. Building a dedicated cGMP manufacturing facility.

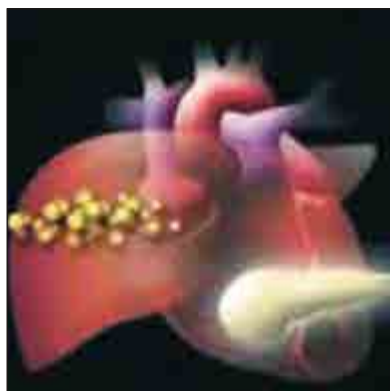
**Level of Satisfaction:** 9/10



**Title of Innovation:** Novel Strategy to address Cardio Metabolic Risk Reduction.

[Funded under Scheme: BIPP]

Collaborating Partners: None



## Brief Description of the Innovation

**Stage of Development:** Phase-I clinical trials have been completed. The molecule is currently in Phase II clinical trial to study the safety and efficacy of TRC for the treatment of CMR in diabetic / Pre-diabetic patients with dyslipidemia and hypertension.

**Innovative element (s):** TRC150094 is a T2 (Diiodothyronine) mimetic that aims at increasing energy expenditure, thereby correcting the imbalance due to over nutrition.

**Market Potential:** The economic burden of cardio-metabolic risk in India is estimated to be more than Rs. 20,000 crore which is around 1% of GDP. Therefore, there is an urgent need to develop novel therapeutic agents to address CMR and prevent development and progression of complications.

**National/ Societal Relevance:** "Cardio-Metabolic Risk" (CMR) described as the overall risk of cardiovascular disease (CVD) and diabetes is a major unmet need especially in the context of "Asian Indian Phenotype" which correlates with increased insulin resistance (IR) and greater visceral adiposity among other factors. Visceral adiposity develops due to chronic imbalance between energy intake and energy expenditure resulting in excessive fat accumulation and co-morbidities. In India, the metabolic syndrome patient population was estimated around 135 million in 2008, which will increase to around 170 million by 2020.

**Potential of IP generation:** TRC150094 is an indigenous NCE developed and patented by Torrent Pharmaceuticals Ltd for treatment of CMR associated with non-traditional risk factors such as obesity, IR and elevated triglycerides.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** In Preclinical Studies with various disease models of cardio-metabolic disorder, TRC150094 has shown excellent efficacy and wide safety.

**Plan to take innovation further:** Further pivotal studies will be planned based on the results from these studies after the completion of phase II.

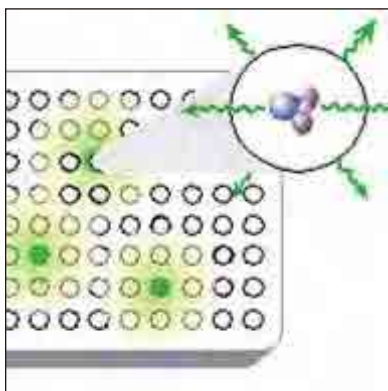
**Level of Satisfaction:** 9/10

## Address

Torrent Pharmaceuticals Limited  
Off. Ashram Road,  
Ahmedabad - 380 009,  
Gujarat



**Title of Innovation:** To develop novel 3rd Generation HIV (Antibody) & 4th Generation (HIV Antigen and Antibody) immunoassay format using flash type chemiluminescence and magnetic particles as matrix. [Funded under Scheme: BIPP]  
**Collaborating Partners:** None



## Team Members (including Collaborators)

Dr. Amitabha De  
Dr. Syed Akhtar  
Dr. Hardeep Vora,

## Brief Description of the Innovation

**Stage of Development:** The project is currently in the validation stage.

**Innovative element(s):** Development of FLASH chemiluminescence based 3rd and 4th generation HIV assays using magnetic beads as matrix. The project utilizes monoclonal antibodies for the detection of p24 antigen and recombinant antigens for the detection of anti-HIV antibodies. After successful development, the assay would help to detect much lower levels of antibodies and the p24 antigen, thereby decreasing the window period between infection and detection as compared to standard ELISAs. The system will be used to further develop other qualitative and quantitative assays on similar format.

**Market Potential:** The use of common reagents such as magnetic bead matrix, washing solutions and detection agents will reduce the cost of development of new products.

**National/ Societal Relevance:** Being an indigenously developed product, the diagnostic test will be available to a large population at an affordable cost while the automation of the test along with use of FLASH type chemiluminescence will ensure high throughput with reduced turn-around time.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** Developed a prototype ELISA assay using biomolecules validated for sensitivity and specificity against a large panel of known HIV positive and negative samples. These biomolecules are being tested on the magnetic bead matrix for assay performance parameters.

**Plan to take innovation further:** Since many of the reagents used in the assay are generic (magnetic beads, detection reagents etc), we plan to develop other qualitative and quantitative assays for detection of analytes such as Hepatitis B, Hepatitis C, Hormones, Thyroid panel etc on the same principles.

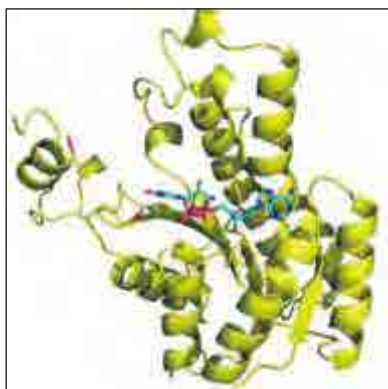
**Level of Satisfaction:** 7/10

## Address

Transasia Bio-Medicals Ltd  
Transasia House, 8 Chandivali  
Studio Road, Andheri (E),  
Mumbai - 400 072



**Title of Innovation:** Novel inhibitors of fatty acid biosynthesis for the treatment of drug resistant S.aureus bacterial infections. [Funded under Scheme: BIPP]  
Collaborating Partners: None



**Team Members  
(including Collaborators)**

Chandrasekhar Alapati  
Ankita Banerjee  
Rajinder Kumar

## Brief Description of the Innovation

**Stage of Development:** This project is at a proof-of-concept stage and aims to identify a novel drug to treat skin infections, pneumonia and bacteraemia caused by S.aureus.

**Innovation element:** A novel lead optimized series of compounds targeting fatty acid biosynthesis in S.aureus has been identified. The patented series is orally bioavailable with pharmacokinetic features suitable for IV/oral dosing. It has shown potent anti-Staphylococcal activity, target specificity and efficacy in primary and secondary infection models. The activity is conserved across MDR clinical isolates, validating our hypothesis that a novel chemical scaffold overcomes existing resistance.

**Market Potential:** A drug emerging from this research has the potential to achieve peak sales of US\$ 100-200 million covering worldwide markets.

**National/ Societal Relevance:** Highly resistant S.aureus, also known as MRSA, account for 40-50% of S.aureus isolates identified in the clinic in India and are associated with increased morbidity and mortality.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** Scheduled milestone completion and

**Plan to take innovation further:** Establishing the safety window and progress towards IND filing.

**Level of Satisfaction:** 8/10

**Address**

Vitas Pharma Research  
Private Limited  
Technology Business Incubator  
University of Hyderabad  
C.R. Rao Road, Gachibowli  
Hyderabad - 500046



**Title of Innovation:** Clinical investigation of Galnobax® for the treatment of diabetic foot ulcer. [Funded under Scheme: BIPP]

Collaborating Partners: None



## Team Members (including Collaborators)

Sudhir Kulkarni  
S. Karanam  
Yogini Garud

## Brief Description of the Innovation

**Stage of Development:** Validation. Currently company is conducting phase I/II clinical trial for this product.

**Innovative element(s):** Galnobax® is a product discovered with a novel formulation as topical gel as well as novel use in treatment of diabetic foot ulcers (DFU) of existing cardiac drug. Galnobax® has shown excellent efficacy profile compared to control in animal studies,

**Market Potential:** The market potential can be estimated from high prevalence of diabetes world over: 366 million patients in 2011 with ~61 million in India and expected to be 552 million by 2030.

**National/ Societal Relevance:** 15% of diabetics lead to DFU in life time and 85% of limb amputations are due to DFU. DFU is an unmet need with platelet derived growth factor as only treatment available. Galnobax® would not only be affordable but also easily administrable and available.

**Risk Factor:** The efficacy of Galnobax® in human population remains as a risk factor.

**IP status:** Company has filed two international patents for this discovery and secured grant in India, Japan and EU.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** Timely completion of recruitment in clinical trial is progress qualifiers.

**Plans to take Innovation further:** Based on results of clinical trial, company plans to utilize product in other chronic wounds.

**Level of Satisfaction:** 8/10

## Address

VLife Sciences Technologies  
Pvt. Ltd., 2nd Floor, Plot No. 05,  
Next to Sapling Nursery,  
Ram Indu Park, Survey  
No-131/1b/2/11, Baner Road,  
Pune - 411045, Maharashtra



**Title of Innovation:** Genetically Engineered Zebrafish as Cancer Models. [Funded under Scheme: BIG]  
**Collaborating Partners:** Dr. Reddy's Institute of Life Sciences



**Team Members  
(including Collaborators)**  
Kiranam Chatti  
Randall T. Peterson

**Brief Description of the Innovation**

**Innovation Elements:** The innovation is the development of cancer models in zebrafish by creating transgenic and/or knockout zebrafish overexpressing tyrosine kinase oncogenes or lacking tumour suppressor genes.

**Market Potential:** Such zebrafish will be valuable in global preclinical research and drug discovery markets.

**Risk Factor:** The risk involved in using a genetic engineering strategy in zebrafish is to create a cancer model wherein at the genetic manipulation may not produce a detectable cancer phenotype. A wider selection of genes is being targeted to mitigate the risk.

**National/ Societal Relevance:** Current preclinical cancer studies invariably involve mice as animal models. In India, access to transgenic mice and mouse cancer models is limited. An effective way to address this situation is the use of alternative animal models such as zebrafish. Further, the potential research impact and commercial value of such an innovation would be significant.

**PERFORMANCE EVALUATORS**

**Progress Quantifier:** The project was initiated in May 2013. Custom-made research reagents have been prepared.

**Plan to take Innovation Further:** Future plans include filing patent and contacting potential partners for commercialization and/or fund-raising.

**Level of satisfaction:** 7/10

**Address**  
Zephase Therapeutics Pvt. Ltd.  
Institute of Life Sciences,  
University of Hyderabad Campus,  
Gachibowli, Hyderabad - 500 046



**Title of Innovation:** Single Step Extraction of Cottonseed with Miscella Refining.

[Funded under Scheme: BIPP]

Collaborating Partners (if any): None



**Team Members  
(including Collaborators)**

Mr. Ashish O. Mantri

Mr. D. A. Prasad

## Brief Description of the Innovation

**Stage of Development:** Commercialized and catering both domestic and international markets.

**Innovative element(s):** Processing Cottonseed with New Single Step Extraction with Integrated Miscella Refining which produces better Oil with enhanced recoveries. Now we are producing Alternate Vegetable Protein sources for Animal Feeds like Cottonseed Meal, Rapeseed Meal, Castorbean Meal, Guar Meal etc with reduced Anti Nutritional Factors like Gossypol, Glucosinolates, Ricin, Ricinin, Saponins and Allergins etc with also increased Digestibility which gives low FCR (Feed Conversion Ratio).

**Market Potential:** India's production of Alternate Protein sources are 8.5-9 MMT (included only Meals of Cottonseed, Rapeseed and Castorbean). If we produce these materials with ACPL's novel process these can directly replace Soya Bean Meal.

**Risk Factor:** Convincing the consumers who are habituated for Traditional products.

**National/Societal relevance:** Alternate protein sources (Nearly 9 Million Metric Tons) can be fed to animals so that Soyabean Meal could be available for Humans

**Potential for IP generation:** Already applied.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** Quantities of Protein sources being consumed in Animal Feed. ACPL is supplying its Abhay Proteins branded Alternate Protein sources to Poultry, Cattle and Aqua sectors since 2009.

**Plans to take the innovation further:** Planning for new refining technology in which there is no involvement of chemicals, larger quantities of energy and which is able to produce Edible Oils with enhanced Anti-Oxidants and Nutrient levels.

**Level of Satisfaction:** 10/10

**Address**

Abhay Cotex Pvt. Limited  
31 – Gur Market,  
Old Mondha, Near Bus stand,  
Jalna - 431203



**Title of Innovation:** Development of value added Corn Steep Liquor and powder suitable for fermentation and feed/food industry up to pilot scale (1 TPD). [Funded under Scheme: BIPP]  
**Collaborating Partners (if any):** National Chemical Laboratory (NCL) – Pune



**Team Members  
(including Collaborators)**  
Dr. V. V. Jogdanad  
Dr. Sanajy Nene  
Dr. Gadre  
Mr. Harish Tekchandani

### Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative element(s):** The innovation was achieving consistency and removing unwanted components from corn steep.

**Market Potential:** Due to unavailability of technology, Indian corn wet miller are not able to produce value added product. A small quantity of corn steep powder is imported and rest of the user industry is managing with whatever is available. The estimated demand is in the range of 230 to 250 MT per month.

**Risk factor:** There is minimal risk. Food industry may take some time to accept the product.

**National/Societal Relevance:** Being import substitute, nation will save the foreign exchange. Indian fermentation industry will be able to improve their yields. The feed industry also will get a value added supplements. The product can find application as a value added ingredient for supplement formulations.

**Potential for IP generation:** Not applicable.

### PERFORMANCE EVALUATORS

**Progress Quantifier:** The progress quantifiers will be obtaining a stable free flowing corn steep powder having high protein than existing Corn steep liquor, low in phytic acid and lactic acid content.

**Plans to take the innovation further:** The project aims to scale up the process to convert corn steep liquor into a value added product that has increased nutritional values and reduced objectionable substances to get a high quality media ingredient for fermentation industry and a nutrition source for food industry. It is also proposed to convert the product into free flowing powder to get high stability.

**Level of Satisfaction:** 8/10

**Address**  
Anil Ltd.  
P. O. Box 10009,  
Anil Road, Bapunagar,  
Ahmedabad – 380025



**Title of Innovation:** Studies on bioconversion of glycerol, a byproduct of Biodiesel industry, into a economically important 1,3 propandiol, its purification and scaling up. [Funded under Scheme: SBIRI]  
**Collaborating Partners (if any):** None



**Team Members (including Collaborators)**  
Dr. Akhilesh Bhatnagar  
Dr. Tripti Bhatnagar

**Brief Description of the Innovation**

**Stage of Development:** Proof –of- Concept and Validation

**Innovative element(s):** The present project deals with development of commercially viable process for bioconversion of glycerol, a byproduct of Biodiesel industry, into a economically important 1,3 propandiol and its purification.

**Market potential:** The Industrial trends are showing rise in the demand of bio-based products like 1,3-PDO. The 1,3-PDO market was estimated to be \$157 million in 2012 and estimated to be \$560 million in 2019. Polytrimethylene terephthalate (PTT) production is the largest application of 1,3-PDO which is utilized in the manufacturing of carpet and textile to cosmetics, personal, and home care industry. It also has potential to substitute propylene glycol, 1,4-butanediol (BDO), butylenes glycol, and nylon in number of applications.

At present DuPont Tate & Lyle in U.S and Huamei Biomaterial in China are major producers of 1,3 PDO. Thus, there is a requirement of indigenous production of 1,3 propanediol which could be made available at lower costs.

**Risk factor:** The importance of the study would lead to development of a pilot plant study at a large scale where there would be limited risk.

**National/ Societal Relevance:** This project involves the utilization of industrial waste and converts the waste into economical productive process. This project and the future development of pilot study would lead to ecofriendly removal of industrial waste and its conversion to industrially important compound.

**Potential for IP generation:** An Indian process patent has already been applied for.

**PERFORMANCE EVALUATORS**

**Progress Quantifier:** The project is proceeding according to the timelines given by the apex committee report

**Plans to take the innovation further:** Yes, we would like to proceed to the level of pilot study.

**Level of Satisfaction:** 8/10.

**Address**  
Codon Biotech Pvt Ltd.  
C-23,  
Sector - 63  
Noida



**Title of Innovation:** Commercial Scale Stevia Extraction Unit to Produce 0-Calorie Natural Sweetener from Stevia Leaves. [Funded under Scheme: SBIRI]  
**Collaborating Partners (if any):** None



**Team Members (including Collaborators)**  
Mr. Rajpal Singh Gandhi  
Mr. Inderpreet Singh Chawla  
Mr. Amandeep Singh Gandhi

**Address**  
GVS Biotech Pvt. Ltd  
Rest House Market, Gandhi Nagar,  
Banga, Nawashahr,  
Punjab – 144505

### Brief Description of the Innovation

**Stage of Development:** GVS Biotech Pvt. Ltd.(GVSBPL) aims to setup a commercial scale Stevia Extraction unit to produce 0-calorie , natural sweetener from the Stevia Leaves.

**Innovative element:** Because of its natural origins in the Stevia plant, its sweetener does not contain any harmful chemicals often found in artificial sweeteners. Stevia sweetener is safe for diabetics, has been shown to help prevent tooth decay, 0 – Calories, Cholesterol, Chemical, Glycemic Index, Reduces blood Sugar level, Lowers blood pressure, Antibacterial properties -it impedes the growth of bacteria, antifungal, anti-inflammatory, anti-microbial, anti-viral and anti-yeast and has even been recommended by the World Health Organization for use as a treatment for hypertension.

**Risk factors:** Stevia farming is not being promoted much either by Centre Government or State Governments resulting in low availability of raw material.

**Market Potential:** No sweetener currently available on the market has proven to be a fully satisfactory replacement for sugar, but the emergence of Stevia has rekindled hope. There have been many successful product launches using Stevia as sweetener by companies like Coco-Cola , Pepsi Co , Whole Earth , etc replacing the use of Sugar and artificial sweetener .

**National / Societal relevance:** India is going to be a diabetic capital of the world in near future which is a great threat for the society. Development of new diabetic safe products like Stevia shall be a safeguard.

### PERFORMANCE EVALUATORS

**Progress Quantifier:** Discovery of new sweet molecules as Reb D, Reb X, etc in the stevia leaf

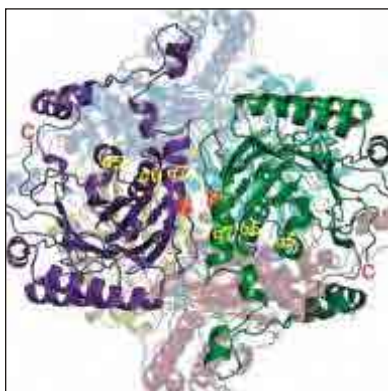
**Plans to take the innovation further:** To further improve taste and reduce the costs of product, ensuring its availability to population at large.

**Level of Satisfaction:** 8/10



**Title of Innovation:** Development of platform technology for nitrilase catalysed biotransformation processes. [Funded under Scheme: SBIRI]

Collaborating Partners (if any): Indian Institute of Technology, Mumbai (IIT-B)



#### Team Members (including Collaborators)

Dr. R. P. Gaikawai  
Mr. Mahendra Savadikar  
Dr. Vaishali Subhedar  
Prof. Pramod Wangikar  
Dr. Sujata Sohoni

#### Address

Hi-Tech BioSciences India Ltd.  
C2/102, Saudamini Complex,  
Survey No. 101/1, Bhusari Colony,  
Paud Road, Kothrud,  
Pune - 411038, Maharashtra

## Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative element (s):** To develop platform technology for nitrilase catalyzed biotransformation processes for synthesis of chiral compounds.

**Market potential:** Nitrilases are emerging as commercially interesting class of enzymes due to their ability to convert nitriles to carboxylic acids in an enantio-selective manner. However, reported nitrilases do not show specificity towards sufficiently broad substrate range with high enantio-selectivity. In order to make the nitrilase based processes commercially competent with the current chemical processes, the enzymes need to be improved for these properties.

**National/ Societal Relevance:** Routine screening of microbial sources for the wild type enzymes having required properties could be time consuming with no guarantee of success. Development of a platform technology which can provide a set of enzymes with improved properties can play a vital role in such scenario, especially, if biotransformation based processes for several different compounds need to be developed in a short time span. Platform technology would provide a library of enzymes having good stability, broad substrate specificity, high enantio-selectivity, and ability to carry out the reactions at high substrate concentrations.

### PERFORMANCE EVALUATORS

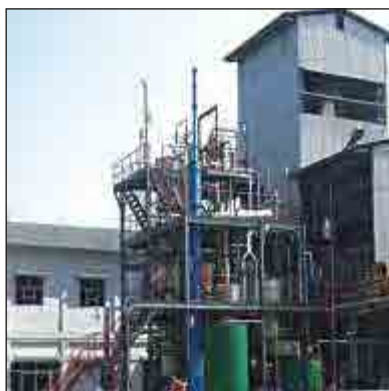
**Progress Quantifiers:** Using bioinformatics approach, microbial nitrilase genes with sufficient diversity were selected at IIT-B. Selected genes were cloned in bacterial expression system and the expression was optimized using different media and fermentation conditions. Both the directed evolution approach and knowledge based rational design approach was used to improve the characteristics of the selected nitrilase enzymes. High through put assay was developed for screening the mutants. Mutants were screened for activity and those showing high activity were selected.

**Plans to take the innovation further:** Selected high activity mutants will be screened for substrate tolerance and enantioselectivity. The enzymes with improved properties would be selected. Expression of these enzymes would be carried out in suitable expression system to prepare panel of nitrilase enzymes with improved properties.



**Title of Innovation:** Setting up of 10 ton Lignocellulosic biomass / day processing plant to produce about 300 Litre ethanol / day (Phase – II : To run the plant in integrated Continuous mode) [Funded under Scheme: BIPP]

Collaborating Partners: DBT-ICT Centre for Energy Biosciences, Institute Of Chemical Technology, Nathalal Parikh Marg, Matunga, Mumbai



## Team Members (including Collaborators)

Dr. Arvind Lali  
Mr. S.R. Soni  
Mr. Alok Singhal  
Mr. Umesh Joshi  
Mr. Prashant Yadav  
Dr. Annamma Anil  
Dr. Abhishek Mule

## Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative element (s):** The inventive features have been established in the following process segments:

- Size reduction and feed slurry preparation from biomass feed (working at 500kg/h ~ 10 ton/day)
- Novel ammonia + nitric acid based two-step continuous fractionation of biomass to cellulose, hemicelluloses and lignin fractions (working at 400kg/h ~ 10ton/day)
- Continuous enzymatic process with enzyme recycle to convert cellulose and hemicellulose into fermentable sugars in yields >90% (working at 15kg/h)
- Microbial conversion of both hexose and pentose sugars to ethanol (validated in 2x50L fermenters from the sugars produced)
- Recycle of ammonia and process water (whatever used)

**Market potential:** Current norms dictate 5% blending of ethanol with gasoline. Although the political will exists to raise this to 10% or higher, there is no ethanol available in quantities enough to meet the projected requirement. With a potentially successful lignocellulosic ethanol technology, this gap can be more than bridged and blends up to 50% ethanol can be possible. There is also an acute shortage of ethanol for chemical processing industries and part of the ethanol produced from biomass will serve as feedstock for these industries.

**Risk factor:** Several novel features of the DBT-ICT Lignocellulosic ethanol technology have been already validated at the plant although in a non-integrated manner. With the material & energy balances calculated, and the performance parameters calculated, the risk factors in further extension of the plant to operate in a continuous integrated flow mode are minimal.

**National/ Societal Relevance:** The need for substantial ethanol production free from vagaries of sugarcane production cannot be overemphasized. With more than 250 million tons of surplus agricultural residue available in the country, putting up of decentralized commercial lignocellulosic ethanol plants each producing about 100KL ethanol/day is a distinct possibility provided a viable and sustainable technology is available.

**Potential for IP generation:** It is conceivable that several innovations are made in the course of pilot plant operation and optimization. These innovations will constitute new IP generated on the pilot plant.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** Earlier phase progress quantifiers are near 100 %.

**Plans to take the innovation further:** It is now desired that the entire plant be integrated to operate at constant and same capacity throughout from biomass size reduction to fermentation in a continuous integrated manner. This is the objective of Phase 2 work on the pilot plant.

The objectives of the Phase 2 of the pilot plant are stated as follows:

- To operate entire plant in continuous mode from size reduction to fermentation.
- To integrate all the five unit operating at tandem capacity of 10 ton biomass/day.

**Level of Satisfaction:** 9/10

## Address

India Glycols Limited  
2B, Sector-126,  
Noida, Gautam Budh Nagar  
Uttar Pradesh - 201304



**Title of Innovation:** Sustainable and versatile microbial polymers: a bio based prospect for India.

[Funded under Scheme: BIPP]

Collaborating Partners (if any): None



**Team Members  
(including Collaborators)**

Dr. Shankar Mohan Singh  
Dr. Maya Paul

## Brief Description of the Innovation

**Stage of Development:** Proof-of-Concept

**Innovative element (s):** Cost effective and green methods of producing Hyaluronic acid, which is a potent biopolymer.

**Market potential:** The current world wide market of Hyaluronic acid is estimated to be over \$1 billion which is expected to be escalated as the therapeutic and aesthetic uses are being extended to a no. of areas.

**Risk factor:** Yet despite the promise of these biopolymers, a series of economic and engineering hurdles impede their introduction to the market.

**National/ Societal Relevance:** Hyaluronic acid is not manufactured in India and moreover it is not afforded in Indian formulations. A domestic manufacturer would be a welcome relief for Indian formulators as it could become affordable and accessible.

**Potential for IP generation:** The research is focused on screening of potent isolates as well as extracting better productivity out of reported isolates. Either objectives hold potential if exclusive results are obtained.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** The progress of research would be revealed in the following data expected to generate:

- Growth curve with respect to time Data illustrating the quantity and quality of product accumulated at different media compositions
- Data illustrating the quantity and quality of product accumulated at different fermentation modes and conditions

**Plans to take the innovation further:** The results if positive would be attempted at pilot scale and after fine tuning at that level would be taken to commercialization.

**Level of Satisfaction:** 8/10

**Address**

Kumar Organics Pvt. Ltd.  
819/C, 13th Cross, 7th Block,  
Near JSS College Circle,  
Jayanagar, Bangalore,  
Karnataka - 560041



**Title of Innovation:** "TOROCELL"- A Novel Disposable Bioreactor System. [Funded under Scheme: SBIRI]  
**Collaborating Partners (if Any):** None



**Team Members  
(including Collaborators)**  
Mr. Ravindranath Gandlur  
Dr. Prasad Rao Gandlur

## Brief Description of the Innovation

**Stage of Development:** Proof of concept

**Innovative element(s):** The unique Gyrotory mechanism that allows the contents of the Bioreactor bag or vessel move in a continuous, uniform circular motion is the main novelty of the system.

**Market potential:** The system has been employed for the medium scale culture of a variety of living cells which include *E. coli*, *Streptomyces avidini*, *Saccharomyces cerevisiae* and *boulardi*, *Pseudomonas putida* and fluorescence, *Bacillus subtilis* and megaterium, Micro algae, *Nodulisporium sylviforme*, SF9 cells, plasmacytomas and hybridomas, CHO, PCEC, BHK21 and VERO cells. A DBT project is on under SBIRI for its application for anchorage dependent cells. The system is useful for Biotech industry and Biotech educational Institutes.

**Risk Factor:** Risk factor is zero. The disposable part of the system is exclusively acceptable polymers such as medical grade PVC, PE-EVA and Polycarbonate in addition to ss316 components.

**National/Societal Relevance:** The innovation is useful Nationally and Internationally and makes Biotechnology processes economical and will earn precious foreign exchange.

**Potential for IP generation:** Indian and International patents have been applied for.

## PERFORMANCE EVALUATORS

**Progress quantifiers:** In addition to demonstrating the growth characteristics of a variety of living organisms, evaluation of their products eg. Enzymes, other proteins such as gene products, antibodies and vaccines will make this project popular in the Industry

**Plans to take the innovation further:** The system is being perfected by incorporating GMP features such as built-in LAF, specialized media conditioning vessels and sampling & monitoring devices.

**Level of satisfaction:** 9/10

## Address

Lablinks Biotech Pvt Ltd  
No. C -16, Kssidc Indl.  
Estate, Hoskote,  
Bangalore – 562114



## **Title of Innovation:** Transformational Technology Platform Development for Biological Hydrogen

[Funded under Scheme: BIPP]

Collaborating Partners (if any): None



### **Team Members (including Collaborators)**

Dr. Banibrata Pandey  
Dr. Samir Kumar Roy  
Dr. Saravanakumar Iyappan  
Mr. Samuel Sudhakaran and  
Mr. Suresh Naik

### **Address**

Nagarjuna Fertilizers and  
Chemicals Pvt Ltd.  
Nagarjuna Hills,  
Hyderabad - 500 082 (AP)

## **Brief Description of the Innovation**

**Stage of Development:** Discovery, Proof-of-Concept and Validation

### **Innovative element(s)**

- Indigenous technology development, designing and implementation of the facility starting from the lab level to pilot level.
- Technology is now ready for scaling up and capacity synchronization to enter semi commercial stage.
- Successful integration of molecular, chemical and electro biochemical tools for producing Hydrogen as a feedstock for various chemicals.
- Biomass/ feedstock processing facility has capability to handle various biomass feedstocks.
- Customized energy crop (Sweet Sorghum) with round the year production, high sugar and low lignin content.
- Organisms engineered to optimize Hydrogen production both in heterotrophic and photoheterotrophic fermentation.

**Market potential:** Hydrogen being the backbone of both chemical and energy sector, there is no limitation of its demand in the market. The goal is to use Hydrogen as a raw material / feed stocks in the chemical industry to replace the chemicals that are presently exclusively dependent on Hydrocarbon as raw material.

**Risk factors:** Continuous availability and high cost of raw materials is a problem.

**National/Societal Relevance:** Hydrogen whether used for energy or as raw material is at present produced from petrochemical route in India. And India imports around 85% of its petrochemicals. Therefore biological hydrogen production is the vehicle to embark upon hydrogen economy. Biohydrogen may also play a vital role for many chemical industries in replacing their petroleum feedstock.

**Potential for IP generation:** A strong Patent (Approved / filed) portfolio of international patents (over 12 PCT applications and over 56 country filing) encompassing all the modules of the platform technology.

## **PERFORMANCE EVALUATORS**

### **Progress Quantifiers**

- Organism manipulation of the targeted genes completed.
- End to end process development for biomass to sugars to fermentation and downstream process completed.
- Process optimization at modular level for all modules completed.
- Multi ton end to end pilot plant up and running, module wise process optimization completed
- Initial process economics data generated

### **Plan(s) to take the innovation further in case the same is nearing completion**

- Final process and cost optimization using capacity synchronized modules at a scale up version which can handle between 50-100 MT raw material/day.
- Further fine tuning of technology related to electrochemical reactor, photoheterotrophic fermentation and lignin gasification.

**Level of satisfaction:** 9/10

# Nagarjuna Fertilizers & Chemicals Ltd.



Industrial

**Title of Innovation:** Development of Technology Platform for Rare Sugar Production Phase 1.

[Funded under Scheme: BIPP]

Collaborating Partners (if Any): None



## Team Members (including Collaborators)

Dr. Banibrata Pandey  
Dr. Samir Kumar Roy  
Dr. Saravanakumar Iyappan  
Dr. Sibnath Ray  
Dr. Cherish Babu and  
Mr. Chiranjeevi

## Brief Description of the Innovation

**Stage of Development:** Proof-of-Concept

### Innovative element(s)

- The three rare sugars (D-Psicose, Trehalulose and Isomaltulose) have been produced using the recombinant protein production approach for the first time at gram scale.
- Novel and improved method (in vivo & in vitro) for rare sugar production in prokaryotic system.
- Rare sugars have been produced using immobilized recombinant enzymes expressed and purified from E. coli.
- The technology platform can use wide range of raw materials including cellulosic sugars.

**Market potential:** Rare sugars have wide applications in areas of nutraceuticals, foods for specified health uses, healthy foods and beverages, food materials, foods and beverages, sweeteners, seasonings, agricultural chemicals that induce resistance against diseases, as plant growth regulators, in pharmaceuticals, in organ conservation solutions, used as high value building blocks for the preparation of pharmaceutical products etc.

**Risk factor:** In India none attempted to produce these proposed rare sugars using recombinant protein and it has a first mover advantage, however there may be some risks which includes Regulatory risk and market competition.

**National/Societal Relevance:** Although rare sugar are known for quite sometimes however the growth of this sector is not very promising due to constrain of suitable technologies. There is a tremendous potential in rare sugar market such as in areas of pharmaceuticals, nutraceuticals, artificial sweeteners, agriculture etc.

**Potential for IP generation:** Already filed 3 PCT (International applications) encompassing the modules of the platform technology.

## PERFORMANCE EVALUATORS

**Progress Quantifiers:** Production of D-Psicose, Isomaltulose and Trehalulose through recombinant enzyme technology and their production at gram level scale basis. All the milestones achieved within timeline.

**Plan(s) to take the innovation further in case the same is nearing completion:** Development of a successful technology platform and techno-economical analysis for the production of Isomaltulose, Trehalulose, D-Psicose, D-Allose & D-Xylulose from proof of concept to proof of value at the targeted (50-100 Kg/day) capacities within next 2 years.

- Further fine tuning of technology in the areas of
- Recombinant protein production in yeast
- Cell surface display of targeted enzymes in yeast
- Expression in plant system

**Level of Satisfaction:** 10/10

## Address

Nagarjuna Fertilizers and  
Chemicals Pvt Ltd.  
Nagarjuna Hills,  
Hyderabad - 500 082 (AP)

# Oriental Aquamarine Biotech India Pvt. Ltd.



Industrial

**Title of Innovation:** Nitrifying Bioreactor Technology for the establishment of Recirculating Aquaculture Systems. [Funded under Scheme: SBIRI]  
**Collaborating Partners:** National Centre for Aquatic Animal Health, Cochin University of Science and Technology, Kochi



**Team Members (including Collaborators)**  
Mr. Mohan Kandaswamy  
Prof. (Dr.) I. S. Bright Singh

## Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative element(s):** The Nitrifying Bioreactors are activated with a specific Nitrifying Bacterial Consortium. This consortium is available at 3 salinity levels – 0 ppt, 15 ppt, and 30 ppt. This ensures that the system can be used in freshwater, Marine and Brackish Water Aquaculture Systems. The presence of a specific consortium also ensures quick startup at the site.

**Market potential:** The products are targeted at Hatcheries of finfish and shellfishes, Maturation systems and Ornamental Fish Breeding units in India and abroad. The global market for fisheries and aquaculture is pegged at 123 million tons according to a report by Global Industry Analysts, Inc. Aquaculture contributes to over 60% of the world's demand for fish. Global Aquaculture has been experiencing rapid and steady growth of around 8% per annum over the last decade and is expected to grow by 50% by 2030. Asia-Pacific region is the leading global region for Aquaculture and Fisheries with more than 60% of their total animal protein consumed coming from fish.

**Risk factor:** Overcoming any mental block that hatchery technicians may have from years of doing it differently.

**National/ Societal Relevance:** An indigenous technology for nitrification and de-nitrification of water for the establishment of Recirculating Aquaculture Systems, especially for seed production and maturation, could be brought out with SBIRI funding, which would help the aquaculture industry to attain stability and sustainability.

**Potential for IP generation:** The technology has been patented in India (Patent no. 241648) The technology has also been patented in other countries like Thailand, Japan, Philippines, South Korea and Indonesia etc. as well as under the Patent Cooperation Treaty (PCT)

## PERFORMANCE EVALUATORS

**Progress Quantifier:** Efficiency in removal of toxic nitrogenous compounds (ammonia and nitrite) from the Aquaculture System.

**Plans to take the innovation further:** The company proposes to scale up its operations in India and other countries with a well-developed aquaculture industry via strategic partnerships.

**Level of Satisfaction:** 7/10

**Address**  
Oriental Aquamarine Biotech  
India Private Limited  
U 7, Kovaipudur,  
Coimbatore - 641042



**Title of Innovation:** Lignocellulosic Biomass to Ethanol Technology – Simultaneous Saccharification and Fermentation. [Funded under Scheme: BIPP]  
Collaborating Partners: None



## Team Members (including Collaborators)

Dr. Ashvini Shete  
Dr. Pramod Kumbhar  
Mr. Ravikumar Rao  
Mr. Sambhaji Chavan  
Ms. Durga Aphale

## Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative element(s):** A thermotolerant yeast strain of *Candida glabrata* has been identified as the preferred strain for SSF of Praj pretreated feedstocks like cane bagasse and corn cob. The strain is capable of fermenting Praj pretreated feedstocks at 42°C efficiently. The yeast strain which can minimally utilize ethanol was developed by ADH knockout as well as by mutagenesis.

**Market potential:** The blending level of 5% (E5) of bio-ethanol with gasoline has already been made mandatory. Over the next decade, both demand and production of ethanol are expected to increase dramatically, as nations require and seek out more renewable fuel sources, and the industry finds more viable feedstocks and more efficient ways to produce fuel ethanol.

**Risk Factors:** Feedstock availability, supply chain and cost, enzyme availability and cost.

**National / Societal relevance:** Development of second generation ethanol technology is the need of the hour for India to save billions of foreign exchange spent on crude oil. In India, there is surplus lignocellulosic material like cane bagasse which is either used as a boiler feed or cane trash which is simply burnt in fields. This can become a useful resource for its conversion into highly useful product that is ethanol.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** Two milestones have been met on the scheduled time

**Plans to take the innovation further:** Integration of the process in the current Praj cellulosic ethanol technology

**Level of Satisfaction:** 10/10

## Address

Praj Industries Limited  
PRAJ-Matrix - The Innovation  
Center, 402/ 403/ 1098, Urawade,  
At. Pirangut, Tal. Mulshi, Dist. Pune



**Title of Innovation:** Viable Enzymes production using Agro waste/Produce as Raw material of Industrial/Feed and Health care use with large viable Market/Demand. [Funded under Scheme: BIPP]  
**Collaborating Partners:** None



**Team Members  
(including Collaborators)**

Dr. Vadiraj Jahagirdar  
Dr. Vasudeo Zambre  
Dr. Amey Damle  
Ms. Smita Mahajan  
Ms. Bhakti Manohar  
Mr. Raturaj K.  
Mr. Ayan Dhar  
Mr. Aarti Gawande

**Address**  
Rossari Biotech  
201-A & B, Ackruti Corporate Park,  
LBS Marg, Next to GE Gardens,  
Kanjurmarg (W.), Mumbai 400 078

**Brief Description of the Innovation**

**Stage of Validation:** Proof of concept and scale-up

**Innovative element(s):** We have successfully produced two enzymes viz. cellulase and pectinase by using agricultural waste and agricultural produce. We have successfully scaled up cellulase enzyme fermentation by use of agri-waste.

**Market potential:** The two enzymes – cellulase and pectinase has great market potential. Cellulase finds application in textile wet processing like denim fading and cotton biopolishing. Cellulase is also used in breweries, alcohol production, various food processing, feed supplement and detergent industries. Pectinase is used in Bioscouring process. This application of pectinase can replace harsh chemical sodium hydroxide which is used in conventional scouring process. Pectinase also finds use in fruit juice clarification, natural extract industry, Tea processing, Breweries, food processing, feed supplement.

**Risk factor**

- Lack of awareness regarding use of enzyme in various processes.
- Presence of MNC's in India and worldwide who are making similar enzymes
- Dumping of low cost material by China

**National/ Societal relevance**

- Import substitute
- Development of In-house technology for self sufficiency in biotechnology field.
- Generation of employment opportunities for Biotechnology sector.

**PERFORMANCE EVALUATORS**

**Progress Quantifier:** As per the plan of project two enzymes viz. cellulase and pectinase have been scaled up from lab studies to 1000L fermenter. Innovative element like use of agri waste in production of cellulase has been completed.

**Plans to take the innovation further:** We plan to take these products to commercialization level using 30/50 KL fermenter.

**Level of Satisfaction:** 8/10



**Title of Innovation:** Seaweed Biofuel - Cost-effective offshore biomass production and bioconversion to fuel. [Funded under Scheme: BIPP]  
**Collaborating Partners:** None



**Team Members  
(including Collaborators)**  
Ms. Sailaja Nori  
Mr. Sawan Kumar  
Ms. Sowmya Balendran  
Mr. Nelson Vadassery  
Mr. Shrikumar Suryanarayan

### Brief Description of the Innovation

**Stage of Development:** Proof of concept

**Innovative Element(s):** We're developing systems to cultivate macroalgae in rough ocean conditions at large scales and lowered costs and subsequently convert the biomass into ethanol completely in a salt water environment through enzymatic hydrolysis and fermentation, thereby eliminating the need for fresh water. Taken together this allows the development of a biofuel technology which is not limited by the availability of land and fresh water, two resources extremely crucial for food production. We have currently developed proof of concept and are currently validating it.

**Market Potential:** The market potential for bio-based ethanol as a fuel substitute in India alone is around Rs 25,000 crores.

**Risk Factor:** Potential risks involve market fluctuations in crude oil prices, but the fact that the cultivated seaweed itself is a valuable commodity today insures us against this.

**National/ Societal Relevance:** The project has the possibility to bring about energy independence for the nation while potentially creating a whole new source of livelihood for the various coastal communities.

**Potential for IP generation:** We've applied for patents on our technology, both on our seaweed cultivation system and the seawater based bioconversion technology.

### PERFORMANCE EVALUATORS

**Progress Quantifier:** Our progress to date on the project has been very satisfying and we've completed all our milestones on time.

**Plans to take the innovation further:** Our intention, upon completing this project is to scale up our technology to set up a pilot plant to demonstrate commercial scale up feasibility.

**Level of satisfaction:** 9/10

**Address**  
Sea6 Energy Pvt. Ltd.  
#843, A Block  
Sahakar Nagar main Road  
Bangalore - 560092



**Title of Innovation:** Development of Anaerobic Membrane Bioreactor (AnMBR) for Waste to Energy Solution. [Funded under Scheme: BIPP]  
**Collaborating Partners:** None



**Team Members (including Collaborators)**  
Dr. R. R. Sonde  
Dr. V. Kalyan Raman  
Dr. U. S. Adhyapak  
Mr. Janardhan Bornare

**Address**  
Thermax Limited  
Thermax House, 14  
Mumbai - Pune Road,  
Wakdewadi, Pune - 411 003

### Brief Description of the Innovation

**Stage of Development:** Proof-of-Concept / Validation

**Innovative element (s):** Anaerobic digesters with membrane separation unit (Anaerobic Membrane Bioreactors - AnMBRs) facilitate retention of microorganisms and allow operation with high biomass concentration. Thus, AnMBRs provides more efficient digestion, higher methane production, better effluent quality, and can be smaller in size than conventional anaerobic digesters treating low organic strength wastewater.

**Market potential:** In 2011, the global Membrane Bioreactor (MBR) market was estimated at USD 838.2 million and is projected to grow at an average annual rate of 22.4 percent, reaching a total market size of USD 3.44 billion in 2018. Establishing AnMBR technology will give more edge over existing aerobic based MBR and hence can increase market share.

**Risk factor:** The major challenges are to generate biogas from low to medium strength wastewater and integrate quality membrane to keep sufficient permeate flux by reducing fouling on membrane surface.

**National/Societal Relevance:** With increasing water demand and depleting water availability, recycling of domestic wastewater has huge potential to bridge the water scarcity and provide good source of water for non-potable uses. Since the AnMBR technology produces energy from wastewater and also treat wastewater, it can create major impact in developing countries like India by providing sustainable solutions towards energy demand and waste management issues.

**Potential for IP generation:** Innovative steps are identified in the developed treatment process and patent filing is in progress. Additional innovations and IP generation are also expected in next phase of the project development.

### PERFORMANCE EVALUATORS

**Progress Quantifier:** The project has delivered the stipulated objectives and has achieved all targeted deliverables as per timelines / milestones of the project. The project is in the last phase of demonstration of the technology.

**Plans to take the innovation further:** An AnMBR demonstration/commercial plant of 100 m3/day capacity is planned to take-up for the treatment of domestic wastewater.

**Level of Satisfaction:** 10/10



**Title of Innovation:** Indigenous Production of Dextranase using SSF technique.

[Funded under Scheme: SBIRI]

Collaborating Partners: None



## Team Members

(including Collaborators)

Mr. Prabhat Shanker Pandey

Dr. Suman Misra

## Brief Description of the Innovation

**Stage of Development:** Proof of concept and Validation

**Innovative element(s):** First time in world Dextranase has been produced using solid state fermentation and first indigenous production of Dextranase. Dextranase developed by Varuna under SBIRI support Phase I has been standardized with Sigma Dextran T500 standard and achieved 30000 du/gm level. This Dextranase (Branded as Dextrasol) achieved 51% average reduction in Cane sugar production process

**Market potential:** Potential use of Dextranase in cane sugar production 2013-14 is 1185 ton in India based on estimated 237 million ton crushing @ dose of 5 gm per ton of cane crushed. Export potential of Dextranase is in Brazil, Thailand, Vietnam, East Africa is significant.

**Risk factor:** There is competition from China.

## National/societal relevance

- We are targeting to grab 10% of cane sugar production in India within 3 years which will help our nation to save US\$ 4.00 million
- Application of Dextrasol from Varuna will support sugar industry about Rs 10 crores by import substitution
- Our citizens will have better and healthier sugar.

**Potential for IP generation:** the technology of production is unique and has potential for IP generation.

## PERFORMANCE EVALUATORS

**Progress quantifier:** Team Varuna has successfully achieved objectives of Dextranase production using SSF Phase I, supported by SBIRI, technically and financially, and have moved to Phase II for commercialization. Based on pilot scale production we have created customers in India and by December 2013 we will be ready with commissioned plant to serve sugar season 2013-14.

**Plans to take the innovative further:** Team Varuna is working on purified Dextranase for application in dental plaque removal.

**Level of satisfaction:** 9/10

## Address

Varuna Biocell Pvt. Ltd.  
Gangotri, Ravindrapuri Extension,  
Durgakund Road,  
Varanasi- 221005

**Title of Innovation:** Third generation RNAi for engineering Tomato leaf curl (ToLCV) and tospovirus (GBNV) resistance in tomato. [Funded under Scheme: BIPP]  
Collaborating Partners: ICGEB



## Team Members (including Collaborators)

Dr. Ashwin Kashikar  
Mrs. Swati Gore  
Mr. Sachin Misal  
Dr. Sunil Kumar Mukharjee

**Address**  
Ankur Seeds Pvt. Ltd.  
27, New Cotton Market  
Layout  
Nagpur - 440018

## Brief Description of the Innovation

**Stage of Development:** Proof of Concept

**Innovative element (s):** Artificial Micro RNA constructs (amiR and TasiRNA) development for transgenic Tomato development

**Market potential:** Hybrid tomato occupies 20% of highly competitive and expanding hybrid vegetable seeds market. The market is getting more refined in terms of quality and yield expectations and there is a clear demand for perfect hybrids. Among other traits, the market requirements also include tomato hybrids with resistance to major viral diseases, like tomato leaf curl virus (ToLCV) and groundnut bud necrosis virus (GBNV). Resistance breeding has offered incremental gains towards commercializing new virus tolerant hybrids, especially for leaf curl disease. However, this type of resistance shows spatiotemporal fluctuations and is bound to be neutralized by rapidly evolving viral genomes. Genetic engineering, on the other hand offers a possibility of developing effective, broad-spectrum and durable resistance against major viruses

**Risk factor:** The project is a "high risk- high return" proposition for the company. The work involves very new concepts of gene silencing technology. The project, if successful, will allow us to take the next step of mobilizing the developed virus resistance traits into our elite hybrids and seek regulatory approval for its commercialization at field level. The commercialized virus resistance trait will not only boost company's annual revenue from hybrid tomato sales, but also enable us to earn from sublicensing the trait to other enterprises

**National/ Societal Relevance:** Present project will be beneficial for the society by generating more yield through Tomato leaf curl and Tospo virus resistance hybrids, it will help to build better economy for the nation.

**Potential for IP generation:** RNAi technology based on principles of miRNA and tasiRNA will be employed for engineering virus resistance trait in this project. A process to silence Tomato leaf curl virus genome through artificial miRNA has been developed at ICGEB, New Delhi (Yadava and Mukherjee, 2010; Provisional patent filing in progress). This technology will be further refined and scaled up in the present proposal. Beside artificial miRNA, the project envisages to invent a process of silencing geminiviral and tospoviral genomes using tasiRNAs and also a process to silence multiple genes using polycistronic miRNA precursors. The later two activities would result in new IP generation and culminate in filing patents on priority basis.

## PERFORMANCE EVALUATORS

### Progress Quantifier

• Artificial MicroRNA construct preparation for ToLCV and tospovirus resistance.- Done • High through Tomato transformation – Going on • Transgenic event for all amiR construct - Yes • Segregation analysis for developed transgenic events – Going on

**Plans to take the innovation further:** Transgenic development as well as validation through artificial micro RNA expression analysis and agro-inoculation. New Tasi-RNA constructs development and transgenic development

**Level of Satisfaction:** 7/10



**Title of innovation:** Development of 'Herbicide and Stress Tolerant' Transgenic Onion.  
[Funded under Scheme: BIPP]  
Collaborating Partners: International Centre for Genetic Engineering & Biotechnology, New Delhi.



**Team Members  
(including Collaborators)**  
Dr. Nandkumar Kunchge  
Dr. B. Mazumdar  
Mr. Sameer Agrawal  
Dr. Narendra Tuteja

**Address**  
Bejo Sheetal Seeds Pvt. Ltd.,  
Bejo Sheetal Corner,  
Mantha Road,  
Jalna - 431203

### Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative Element(s):** EPSPS and PDH45 genes isolated from mutant Rye grass and pea plants respectively confirmed for herbicide tolerance and stress tolerance in model crop Tobacco with significant level of tolerance. The proof of concept is ready and the technology is being validated in tropical Onion. PDH 45 plant based gene confers tolerance to salt and draught in Onion would be innovative concept. Genetic transformation in tropical Onion has been achieved by developing Agrobacterium mediated reproducible protocol using nptII or hpt or EPSPS gene as selectable marker. Primary transgenic plants produced using target gene Rye grass EPSPS and PDH 45. Molecular characterization and gene expression studies are in progress.

**Market Potential:** India is second largest producer of onion in the World after China, however the productivity (14 MT/Ha) is far lower than Worlds average productivity (19 MT/Ha). In India Onion plays an important role also in Social/political culture.

**Risk Factor:** The major limitation in Onion crop cultivation is weed emergence and draught.

**National/ Societal Relevance:** Weed emergence in Onion field, inconsistent rains/ irrigation sources and saline soil are major problems in increasing the yield of onion bulbs/seeds and up to 96% losses are reported. Hence transgenic onion with herbicide and stress tolerance would be important. In India market demand for such product would be high if commercialized. However the major risks in developing such product would, deployment duration for commercialization, environmental safety issues, creating awareness in society.

### PERFORMANCE EVALUATORS

**Progress Quantifier:** Seven objectives completed and three are ongoing

**Plans to take the innovation further:** Yes

**Level of Satisfaction:** 7/10



**Title of Innovation:** Generation of Transgenic Events of Elite Cotton Breeding Lines.  
[Funded under Scheme: SBIRI]  
Collaborating Partners: None



**Team Members  
(including Collaborators)**  
Dr. S. K. Raina  
Mr. N. Kamlaker  
Mr. V. Parikh

**Address**  
Global Transgenes Limited  
Nath House, Nath Road,  
PO -318, Aurangabad - 431005,  
Maharashtra

**Brief Description of the Innovation**

**Stage of Development:** Proof of Concept and Validation in progress  
**Innovative element (s):** Generation of Transgenic Events Encoding Novel (synthetic & codon optimized) Bt proteins.  
**Market potential:** Yes  
**Risk factor:** Approval for Commercialization by the GEAC  
**National/ Societal Relevance:** Alternative to the existing Bt-Cotton technology by Monsanto  
**Potential for IP generation:** Yes

**PERFORMANCE EVALUATORS**

**Progress Quantifier:** Level of Success has been achieved in just 4-years (including 2-years with SBIRI).  
**Plans to take the innovation further:** Through Breeding, Genetic Validation and Regulatory Oversight for Biosafety.  
**Level of Satisfaction:** 8/10



**Title of Innovation:** Development and scale – up of novel biopesticides based on *M. anisopliae* for control *Helicoverpa armigera* (Phase – I). [Funded under Scheme: SBIRI]  
Collaborating Partners: National Chemical Laboratory, Pune



## Team Members (including Collaborators)

Dr. R. P. Gaikawai  
Mr. Mahendra Savadikar  
Dr. Vaishali Subhedar  
Dr. M V Deshpande  
Dr. Jayant Khire

## Brief Description of the Innovation

**Stage of Development:** Proof of Concept

**Innovative Element(s):** The *M. anisopliae* strains identified and studied by NCL have been shown to be effective in controlling pests as compared to the chemical pesticides and other ecofriendly approaches, such as NPV. Therefore the product has potential for reducing the use of chemical pesticides, which would go a long way in improving the agricultural economics as well as addressing the problem of overuse of pesticides, pesticide residues and resulting environmental degradation

**Market Potential:** It is hypothesized that a knowledge-based formulation(s) of *Metarhizium anisopliae*, backed by advanced biochemical and molecular diagnostics for ensuring the bio-efficacy of the product may also help tackle the issue of shifting of pest and hence would be far superior to the existing products in the market.

**Risk:** Other competing technologies in the market

**National /Societal relevance:** Most of bio-pesticides products based on *M. anisopliae* available in the market today are not sufficiently backed up by a scientific knowledge base to ensure their suitability across widely different agro-climatic conditions in India. There is also a lack of suitable bioassay based quality assurance parameters to measure the potency of the formulations.

## PERFORMANCE EVALUATORS

**Progress Quantifiers:** Currently, the scale-up of the products and study of stability of the formulation is in progress. We have shown that it is possible to reduce the production time of the products from initial 15 days to less than 10 days at an economically viable yield. The bioassays tests of the products have shown great promise in control of *Helicoverpa armigera*. The efficacy of the products would be tested in scientific trials in this season. Research has been carried out to improve the stability of the product and is under testing

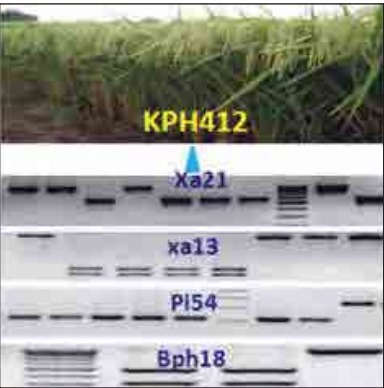
**Plans to take Innovation Further:** Already Hi Tech is in discussions with major pesticide companies in India to conduct efficacy trials in different areas of the country. These companies have shown great interest in commercialization of this product, due to its use in Integrated Pest Management Regime

**Level of Satisfaction:** The initial feedback from the farmers for the products is good. Some improvement is required, but the same would be addressed in the remaining period of the project. 7/10

## Address

Hi Tech BioSciences India Ltd.  
C2/102, Saudamini Complex,  
Survey No. 101/1, Bhusari Colony,  
Paud Road, Kothrud, Pune

**Title of Innovation:** Development of Biotic stress resistant rice through conjunct use of Bio and hybrid technologies. [Funded under Scheme: BIPP]  
**Collaborating Partners:** None



**Team Members (including Collaborators)**  
Dr. N. P. Sarma  
Dr. D. Prasad and  
P. Santosh

**Address**  
Kaveri Seed Company Ltd.  
# 513 B, 5th Floor,  
Minerva Complex, S. D. Road,  
Secundrabad - 500 003

## Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative elements:** Programme is underway to transfer genes for bacterial blight, blast and brown plant hopper resistance into recurrent parents of the popular rice hybrid through Marker Assisted Backcross Breeding (MABB) Selections based on genotyping (foreground & background) and phenotyping are being exercised in the backcross generations. The hybrids per se outperform varieties due to inherent phenomenon of heterosis or hybrid vigour. Hybridity, however, also imparts greater genetic buffering capacity to withstand stress environs (abiotic stress). Built in genetic resistance to major pests in the hybrids adds a third dimension advantage.

**Market Potential:** Rice being a high volume crop the potential for hybrid rice seed demand is huge.

**Risk factor:** Failure to develop competitive hybrids could adversely affect seed business and depends on the product value and performance.

**National / societal relevance:** Seed being the repository of genetic potential, contributes to productivity increase thereby creating revenue pathways to farmers.

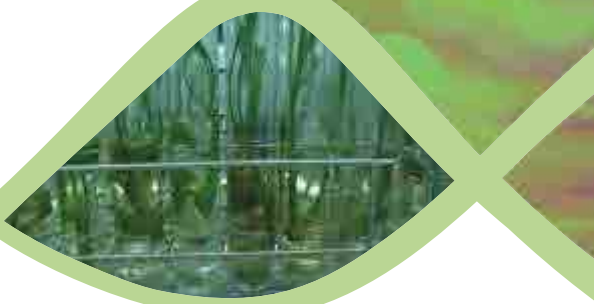
**Potential for IP generation:** The hybrid developed will be registered with PPV & FR for proprietariness of the product.

### PERFORMANCE EVALUATORS

**Progress Quantifiers:** In 24 months time since the project commissioned, the project progress is as per the time lines envisaged.

**Plans to take innovation further:** On the lookout for alternate gene source in lieu of recessive xa13 gene to fortify genetic resistance of hybrid. Plans are afoot to widen the horizon of resistance to other biotic stresses

**Level of Satisfaction:** 8/10



**Title of Innovation:** Marker-assisted dissection of genetic basis of yield and improving yield potential under drought stress in maize  
**Collaborating Partners:** None



**Team Members (including Collaborators)**  
Dr. N. P. Sarma  
Dr G. Srinivas  
Ch. Bheemaiah  
Dr. B.S. Dahiya

**Brief Description of the Innovation**

**Stage of Development:** Validation

**Innovative element(s):** This project aims to improve maize productivity under drought stress through an integrated approach of deploying molecular markers with conventional breeding process. The strategy is to identify genes underlying yield under drought stress via QTLs by tagging with markers through association mapping. The QTLs/genes tagged with markers are enriched among inbreds by marker-assisted recurrent selection (MARS) strategy. Finally, using the improved inbreds, propose to develop high yielding drought tolerant maize hybrids.

**Market potential:** High yielding hybrids with improved tolerance to biotic and abiotic stress always have great market demand. Since maize being primarily grown under rain fed situations, improved hybrids outperforming the existing, under limitations of moisture stress will carry a very high market potential.

**Risk factor:** Failure to develop competitive hybrids could adversely affect seed business and depends on the product value and performance.

**National/Societal Relevance:** In India, maize is cultivated ~8.5m.ha with an annual production of 21mt.and annual consumption of maize is likely to go up, due to increasing demand from poultry sector. Maize productivity in India is half the global average. If the maize yields can be pushed anywhere close to global average, country will have sustained maize production and also scope for export prospect. Therefore, improving maize productivity in drought prone regions is of national relevance in terms of providing adequate grain to the poor farmers and land less labour who depend on maize farming for their livelihood.

**Potential for IP generation:** The hybrid developed will be registered with PPV & FR for propretariness of the company.

**PERFORMANCE EVALUATORS**

**Progress Quantifiers:** In 12 months time since the project commissioned, the project progress is as per the time lines envisaged.

**Plans to take innovation further:** The project will be run as per its design.

**Level of Satisfaction:** 8/10

**Address**  
Kaveri Seed Company Ltd.  
# 513 B, 5th Floor,  
Minerva Complex, S.D.Road,  
Secundrabad - 500 003

**Title of Innovation:** Genomics assisted accelerated product development of high yielding pigeonpea hybrid  
[Funded under Scheme: BIPP]  
**Collaborating Partners:** International Crops Research Institute for Semi-Arid Tropics (ICRISAT), Patancheru, Hyderabad, India.



**Team Members  
(including Collaborators)**  
Dr. Anup Karwa  
Dr. M.S. Kuruvinashetti  
Dr. Rajeev Varshney  
Dr. Kul Bhushan Saxena  
Dr. Rachit Saxena

**Address**  
Krishidhan Research Foundation  
Private Limited  
Krishidhan Seeds Pvt. Ltd.,  
"Krishidhan Bhavan"  
D3 to D6, Addln. MIDC,  
Aurangabad Road,  
Jalna - 431213, Maharashtra

### Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative Element(s):** The project envisages deploying cutting edge molecular assisted breeding strategies to embark on accelerated product development of high yielding pigeonpea hybrids.

**Market Potential:** Pigeonpea is grown in 3.6 mha is poor man's source of protein in India, especially for the large vegetarian population. Increase in per capita income seen in recent years, is going to generate higher demand for protein foods. In that context increase in pigeonpea yields through F1 heterosis is necessary. Presently, the share of hybrids is very meager, about 1- 5 % based on different estimates. Assuming that 1 mha of pigeonpea area is brought under hybrids in the near future, the hybrid seed market itself will be of the order of over Rs. 100 crores. The benefits to the society however will be much larger. Assuming an incremental yield of about 250Kg/ ha it turns out to be Rs. 1000 crores.

**National /Societal relevance:** The genomic sequence data obtained by sequencing parents will be aligned to discover large number of genomewide SNPs. They will be used to find genomic blocks that might contribute to heterosis based on information on the parents and their hybrids. Predicting heterotic patterns and heterotic combinations based on sequence data of parents will be explored. The same SNPs will be used to tag the genes for fertility restoration in A4 cytoplasm based male sterility.

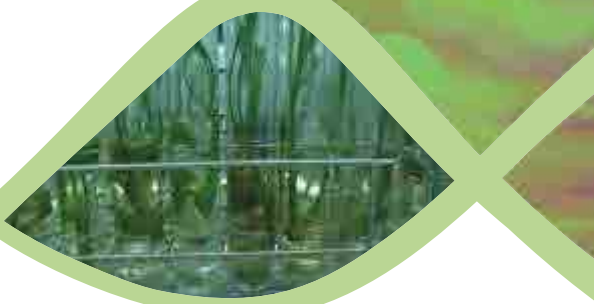
**Potential for IP generation:** No IP as of Now

### PERFORMANCE EVALUATORS

**Progress Quantifiers:** We intend to commercialise high yielding pigeon pea hybrids with viable and sustainable seed production technology.

**Plans to take innovation further:** The work is under way by ICRISAT and Krishidhan to take the work forward

**Level of Satisfaction:** 7/10



**Title of Innovation:** Development of Transgenic Bhendi Resistant to Yellow Vein Mosaic Virus  
**Collaborating Partners:** Molecular Virology Laboratory, School of Life Sciences Jawaharlal Nehru University, New Delhi



**Team Members (including Collaborators)**  
Dr. Anup Karwa  
Dr. M.S. Kuruvinashetti  
Dr. Vilas Kale  
Dr. Supriya Chakraborty

**Address**  
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D3 to D6, Addln.MIDC,  
Aurangabad Road,  
Jalna - 431213, Maharashtra

## Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative element(s):** Biotechnology has shown the use of viral genes for conferring resistance in transgenic plants. The sequence of this begomovirus [DNA-A seven ORFs; DNA -β one ORF] is known. However, mutations, recombination and pseudo-recombination continuously give rise to new variants /strains. Proof of concept and successful examples of resistance through CP and RNAi strategies for other viruses is also known.

**Market Potential:** Bhendi is a popular vegetable with a seed trade value of over Rs. 100 crores. Yellow vein mosaic disease caused by Bhendi yellow vein mosaic virus (BYVMV). It is a major disease of this crop, causing more than 20% damage, with existing management and tolerant varieties. Level of tolerance to BYVMV of the cultivars having introgressed gene from wild bhendi, over 20 years ago, has come down- needing alternative sources of resistance.

**National/Societal Relevance:** Specific purpose of this project is to utilize the complimentary knowledge and skill set available with public Institution and Industry for the production of transgenic yellow vein resistant bhendi for sustaining the agriculture productivity of Okra.

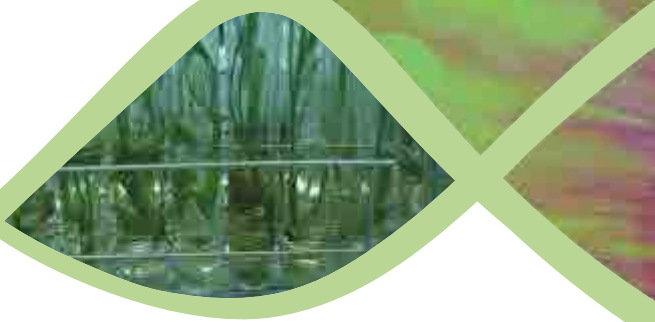
The team will focus on incubating indigenous technology development, regulatory studies and its commercialization in India.

## PERFORMANCE EVALUATORS

**Plan to take the innovation further:** We intend to commercialise superior disease resistant Okra hybrids by undertaking rigorous field testing, regulatory and bio safety studies.

**Progress Quantifiers:** The viral RNAi inserts have been cloned and work is underway

**Level of Satisfaction:** 8/10



**Title of Innovation:** “Stress tolerant rice” and “Sucking pest tolerant cotton and rice”.  
[Funded under Scheme: BIPP]  
Collaborating Partners: None



**Team Members  
(including Collaborators)**  
Dr. Leela Alamalakala  
Pankaj Bihani  
Bharat Char  
Dr. Usha Zehr

**Address**  
Maharashtra Hybrid Seeds  
Company Limited  
Dawalwadi, PO Box 76,  
Jalna (MS) 431203,

### Brief Description of the Innovation

**Stage of Development:** Proof of Concept

**Market Potential:** The thrust of Mahyco's projects are to deploy and evaluate the efficacy of novel candidate genes in major crops against these stresses. Both projects have significant market potential across agro-ecological zones, as Indian agriculture is still largely dependent on adequate and timely rainfall, as well as adequate protection against sucking pests. The methodology used in both projects involves the development and identification of elite transgenic lines expressing the candidate genes.

**Risk Factor:** Risk factors are related to the degree of protection afforded by the genes being evaluated, and whether this component is commercially viable.

**National/Societal relevance:** Abiotic and biotic stresses are the major constraints on agricultural productivity, and India lags behind in this aspect across key crops. Increasing crop productivity is of prime importance for those directly engaged in agriculture. Drought and salinity are abiotic stresses that widely impact our crops while sucking pests are insects which currently cause major crop losses, and have no available remedy except through chemical pesticide application.

**Potential for IP generation:** IP will be generated on events that show significantly improved performance over control lines. Currently these projects are in the advanced proof-of-concept stage, with field validation required.

### PERFORMANCE EVALUATORS

**Progress Quantifiers:** Progress has been quantified in a milestone-based manner, starting with in vitro studies and moving to in planta testing in the greenhouse.

**Plan to take the innovation further:** Plans are to take the best performing lines to the field, for evaluation in event selection trials, and biosafety regulatory trials if warranted.

**Level of Satisfaction:** 7/10

**Title of Innovation:** A proposal for funding of deregulation trials of transgenic rice events expressing Metahelix synthetic Cry1C, Cry1Ac and Cry1Ab genes for tolerance to rice yellow stem borer, *Scirpophagaintertulas*. [Funded under Scheme: BIPP]  
Collaborating Partners: None



## Team Members (including Collaborators)

Mukundanampath  
S. Shivakumar  
S. Sarala  
Prasanna Kumar  
Kiran  
Anil Kumar  
Suresha  
B. P. Ravikumar  
M. J. VasudevaRao  
GauthamNadig

## Address

Metahelix Life Sciences Limited  
Plot No. 3, KIADB 4th Phase,  
Bommasandra,  
Bangalore - 560099, Karnataka

## Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative element (s):** Metahelix has developed large number of transgenic rice events expressing specific insecticidal proteins of Cry1C, Cry1Ab and Cry1Ac targeting towards the control of YSB and other lepidopteran pests. These events were screened for bio-efficacy towards yellow stem borer, confirmation of stable protein expression levels, inheritance pattern studied, bioequivalence studies conducted and stabilized them into potential hybrids. Preliminary bio-safety studies were also conducted. Genes used in this project are Metahelix owned and designed, codon-optimized for rice, express specific insecticidal proteins in the events derived, that have been shown to offer durable tolerance across multiple generations to rice yellow stem borer.

**Market potential:** Rice is grown on approximately 42 m ha in India, and yellow stem borer occurrence is very wide spread and prevalent in most of the rice growing regions causing 38-80% losses to yield especially in late sown crops. Hence, rice hybrids or varieties tolerant to YSB will be preferred by the farmers as they will not only bring in yield benefits, but also reduce the usage of pesticides thus helping to maintain environmental quality. Since events carrying different Cry genes are singly generated it allows the opportunity to develop a stacked gene product.

**Risk factor:** None – as the proposal is for funding of Phase I of deregulation trials which are already well defined and streamlined by Government of India procedures.

**National/ Societal Relevance:** In India rice crop is the major consumer of pesticides next only to cotton. Rice yellow stem borer is a devastating pest of rice causing huge losses. Conventional genetic improvements supported by pesticide usage have only resulted in limited control levels of rice yellow stem borer. The transgenic crop tolerant to yellow stem borer will result in reduction in pesticide use and a consequent increase in yield due to prevention of loss caused by the insect.

**Potential for IP generation:** The genes which are expressed in the events for deregulation trials are Metahelix-owned genes expressing Cry1C, Cry1Ab and Cry1Ac proteins. These are internally-designed codon-optimized genes for high levels of expression in rice. Metahelix has complete freedom to file patents on these genes.

## PERFORMANCE EVALUATORS

### Progress Quantifier

- Event selection report submitted to RCGM on 28th June, 2011.
- Timely Milestone completion report evaluated by Project Monitoring Committee meeting held in 2011 and 2012

**Plans to take the innovation further:** Awaiting the NOC from Andhra Pradesh Government to conduct the BRL-1 trial and subsequently leading to commercialization of rice transgenic events expressing Metahelix designed genes namely Cry1Ab and Cry1Ac.

**Level of Satisfaction:** 7/10

**Title of Innovation:** "Development of Viral resistant okra using RNAi approach".

[Funded under Scheme: BIPP]

Collaborating Partners: University of Delhi South campus



**Team Members  
(including Collaborators)**

Fourteen (14)

## Brief Description of the Innovation

**Stage of Development:** Proof of Concept

**Innovative element (s):** The project aims to develop RNAi constructs designed to provide resistance against Gemini viruses infecting okra. Three innovative steps recognized in this project is the design of RNAi constructs optimized for viral resistance, design and construction of Infectious clones of viruses and development of transformation protocols for okra cultivars identified by the company. Several RNAi constructs will be evaluated for resistance. The best combination or individual gene will be used for okra transformation. Infectious clones of geminiviruses will be constructed for agro inoculation of okra.

**Market potential:** Okra (*Abelmoschus esculentus*) or ladies finger is important vegetable of the tropical countries. The total area and production under this crop is reported to be 838.15 thousand ha and 5,389.4 thousand tons. It is mainly grown in India, Nigeria, Sudan, Pakistan, Ghana, Egypt, Benin, Saudi Arabia, Mexico and Cameroon. Largest area and production is in India followed by Nigeria. Highest productivity is reported from Egypt (15.71 tons/ha) followed by Saudi Arabia (11.53 tons/ha). It is virtually not grown in Europe and North America, yet, lot of people in these countries have started liking this vegetable because of good amount of vitamin A and folic acid, besides carbohydrates, phosphorus, magnesium and potassium. High demanded country includes Palestine, Syria, Tunisia, Greece, Iran, Iraq, Brazil, Lebanon, Turkey and Yemen. YVMV is the major crop disease in okra resulting heavy yield losses, no strategy is available to control the spread of virus. Development of YVMV resistant okra using RNAi approach is a strategy which will increase the Value of this crop. Genotypes developed in this way will be preferred by the farmers and ultimately increasing cultivation and production of crop.

**Risk factor:** The level of resistance may be low or the inoculation procedure may not be robust for large-scale testing for resistance. However, constant survey of literature for adopting any new developments in resistance design and improvement of agro inoculation procedures will be incorporated. There could also be inefficient removal of the marker gene in the transgenic lines, resulting in difficulties in the grant of biosafety clearance. All these factors would be kept in mind during the design of the project.

**National/ Societal Relevance:** *Abelmoschus esculentus* (okra) is cultivated throughout the tropical and warm temperate regions of the world for its fibrous fruits or pods containing round, white seeds. Okra is most widely cultivated in India. It is good source of vitamin B6, vitamin-C, fibre, calcium and folic acid, also rich in protein, minerals, and iodine which helps to nutrition. It prevents neural tube defects in developing fetus. Okra is affected by yellow vein mosaic virus. YVMV infection at 50 to 65 days after germination results in heavy yield losses of 64 to 49 percent. YVMV resistant genotypes developed using RNAi approach will have wide acceptance and increased utility both as nutritional and medicinal crop. This would ultimately benefit Indian farmers and society.

**Potential for IP generation:** Okra lines developed under this project will be registered.

## PERFORMANCE EVALUATORS

### Progress Quantifier

- RNAi constructs will be developed
- Agro infectious clones will be developed
- Okra regeneration and transformations protocol will be standardized
- Screening of okra lines using different method of virus inoculation

**Plans to take the innovation further:** Different methodologies for okra regeneration and transformation will be adopted and RNAi construct developed at Delhi university will be used for transformation of elite okra lines. Screening methodology for virus resistance will be standardized.

**Level of Satisfaction:** 7/10

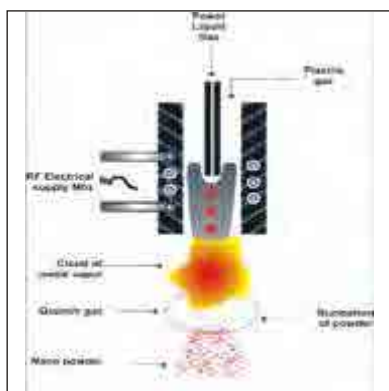
## Address

Nirmal Seeds Pvt. Ltd.  
Bhadgaon Road, Pachora,  
Jalgaon - 424201



**Title of Innovation:** "Commercial Scale Production of Nanopesticides and Nanofungicides for Indian Agro-industry". [Funded under Scheme: BIPP]

Collaborating Partners: Indian Statistical Institute, Kolkata, India



## Team Members (including Collaborators)

Mr. Sanjay Sudan  
Dr. Virendra Patel  
Dr. O. P. Lal  
Dr. Sangeeta Nautiyal  
Dr. Baljinder Kaur  
Dr. Arunava Goswami

## Brief Description of the Innovation

**Stage of Development:** Proof-of-Concept

**Innovative element (s):** The proposal aims at Establishment of Induction Plasma System for Nano powder Synthesis. Delivery Vehicles based on nanotechnology for induction in Integrated Pest Management for qualitative storage of the seeds, food grains and pulses with oblivious advantages over the use of synthetic pesticides presently in use for the purpose. The company and the collaborator have already developed especially surface structured nano silica particles with specific surface engineering which are to be tested in this project for the generation of data which will pave way for further commercialization.

**Market potential:** Pesticide use has increased 50-fold since 1950. India uses about 90,000 tons of pesticides every year, more than 60% of it on food crops. In India pesticide use is bound to increase in coming years, because we cannot afford 10-30% loss during production and post harvest of the cereals, pulses etc.

**Risk factor:** Collaborator's nanoparticle based products are specially structured nanotechnology product. These products have been found to be biologically safe furthermore biosafety studies are an important part of this project to come to the final conclusions based on the present study.

**National/ Societal Relevance:** The product being physical action insecticide in nature compared to the neuro toxic products presently in use. Being environmentally safer, it will have good demand in India especially for the management of stored grain insect pests and for the seed industry as it gives prolonged control of the insect pests.

**Potential for IP generation:** During the studies there is potential for IP generation.

## PERFORMANCE EVALUATORS

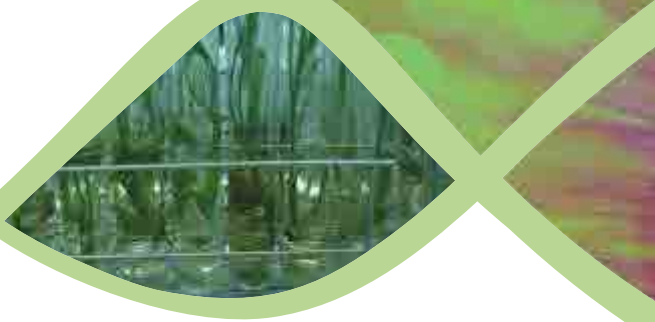
**Progress Quantifier:** This is a pilot project in India for 3 year duration. Presently process for establishment of production unit is in process, which will be followed by testing by bioassay method and under containment facilities for biosafety evaluation.

**Plans to take the innovation further:** Development of market friendly forms of nanopesticides and nanofungicides with addition of suitable stabilizers and dispersing agents for Indian agroclimatic and target crop species. The project will generate data for certification and scaling up the nanocide production at commercial scale for Indian agriculture.

**Level of Satisfaction:** 8/10

## Address

Saveer Biotech Limited  
1442,  
Wazir Nagar,  
New Delhi-110003



**Title of Innovation:** "Development of Actinomycetes based metabolites as delivery systems for soil health management in Groundnut (Arachis hypogaea L)" [Funded under Scheme: BIPP]  
**Collaborating Partners:** "International Crops Research Institute for the Semi- Arid Tropics (ICRISAT)", Hyderabad



**Team Members (including Collaborators)**  
Dr. K R K Reddy  
Dr. HariKishanSudini  
Dr. K R N Reddy

**Address**  
Sri Biotech Laboratories India Ltd.  
Biosphere, Plot No.21, Street No. 2  
Sagar Society, Road No.2,  
Banjara Hills, Hyderabad – 500034

## Brief Description of the Innovation

**Stage of Development:** Validation

**Innovative element (s):** Identified two potential antifungal actinomycetes (SBTA 23 and RP1A 12) strains from Groundnut rhizosphere. Extracted secondary metabolites from these strains and conducted bioassays in order to identify the metabolite and/or metabolite mixtures responsible for inhibiting the growth and multiplication of stem rot pathogen. Further validation of different delivery systems based on these metabolite formulations under in vitro and in vivo are under progress.

**Market potential:** Development of cost-effective, eco-friendly and soil health improving products will have good market potential in a country like India where Groundnut is grown in approximately 5.5 m ha.

**Risk factors:** To our knowledge, we don't see any risk factors as this product is made out of common soil inhabitants.

**National/Societal relevance:** Though large number of improved groundnut cultivars available today, yield potential is not fully explored due to soil-borne pathogens. Therefore, development of eco-friendly product which enhances soil health by reducing the load of harmful organisms in the groundnut rhizosphere is more important to benefit the groundnut farmers.

**Potential IP generation:** The innovation will have scope of both product and process patents for mass multiplication and formulation strategies.

## PERFORMANCE EVALUATORS

**Progress Quantifier:** A total of 220 strains of Actinomycetes were isolated from Groundnut rhizospheres and screened for their efficacy on soil-borne pathogens (Sclerotium rolfsii and Aspergillus flavus) of Groundnut. Out of 220 strains, four strains showed highest efficacy and these were evaluated for production of secondary metabolites. The metabolites extracted from strains (SBTA 23 and RP1A 12), effectively controlled the pathogens under in vitro and in vivo and the potential metabolites are separated. Optimized fermentation conditions for mass production of secondary metabolites from both strains. Developed a formulation with metabolites and evaluation under in vitro and in vivo at different geo-graphical locations is under progress.

**Plans to take the innovation further in case the same is nearing completion:** This innovation further lead us to develop actinomycetes based metabolite products with different delivery systems (seed treatment, soil application etc.) intended usage for groundnut cropping systems.

**Level of Satisfaction:** Our satisfaction level is 10/10



**Title of Innovation:** Control of shoot and fruit borer insect pest (*Leucinodes orbonalis*) in Brinjal through RNA interference". [Funded under Scheme: BIPP]

Collaborating Partners: University of Delhi- South Campus, New Delhi



#### Team Members (including Collaborators)

Dr. K R K Reddy  
Dr. M.V. Rajam  
Dr. K R N Reddy

## Brief Description of the Innovation

**Stage of Development:** Discovery

**Innovative element:** Cloned vital genes Chitin Synthase (CHS), Chitinase (CHI), Acetylcholinesterase (AChE) and Cathepsin (CTSL) from an important insect pest of Brinjal (*Leucinodes orbonalis*). Hair-pin RNAi constructs were prepared for these genes and brinjal transformations were carried out via *Agrobacterium*- mediated transformation using these four hair-pin RNAi constructs harboring insect target genes. Several brinjal transformants were generated, which are being utilized for molecular analysis to demonstrate the transgene integration and expression. Testing of RNAi lines for insect resistance is under progress. Cloning of vital genes of target insect pest of Brinjal and development of transgenic Brinjal plants for resistance to shoot and fruit borer insect pest.

**Market potential:** The developed insect resistant Brinjal without fruit damage would be of great demand in the market and the farmers can significantly reduce the pesticide sprays.

**Risk factor:** To our knowledge, we do not see any risk factors.

**National/Societal relevance:** The damaged brinjal fruits are unfit for human consumption. Therefore, the developed insect resistant brinjal without fruit damage would be preferred for human consumption. In addition, the farming community would benefit economically due to increased fruit yield and quality. Pesticide residues on the harvest will be reduced heavily.

**Potential IP generation:** The innovation will have scope of both isolation and cloning of vital genes of specific insect and product patents. The cloned insect genes were deposited in the NCBI data base, and the accession numbers are JX461234 (for CHS gene), JX44553 (for AChE), JQ756160 (for CHI) and KC514167 (for CTSL).

## PERFORMANCE EVALUATORS

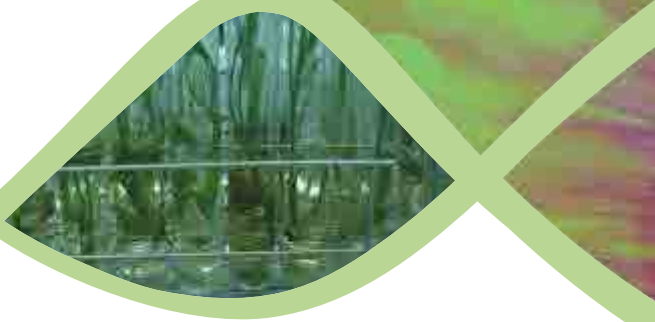
**Progress Quantifier:** Cloned vital genes Chitin Synthase (CHS), Chitinase (CHI), Acetylcholinesterase (AChE) and Cathepsin (CTSL) from an important insect pest of Brinjal (*L. orbonalis*). Hair-pin RNAi constructs for these genes were prepared and transformed to Brinjal plants through *Agrobacterium*- mediated transformations. Generated handful of putative transgenic brinjal plants with the hair-pin RNAi constructs pMVRhp-LoCHS, pMVR-LoCTSL, pMVRhp-LoAChE&pMVR-LoCH and subjected them molecular analysis for showing transgene integration and expression. Testing of RNAi brinjal plants for resistance to target insect pest is under progress. Cloned fruit -specific promoter (SI-EXP & SI-2A11 from tomato) in GUS transformation vector pBI101. Marker-free RNAi brinjal lines are being raised with CHS and CTSL gene under the control of fruit-specific (2A11) and constitutive (CaMV 35S) promoter.

**Plans to take the innovation further:** This innovation further will take up to development of insect resistant brinjal and commercialization.

**Level of Satisfaction:** 10/10

#### Address

Sri Biotech Laboratories India Ltd.  
Biosphere, Plot No.21, Street No. 2  
Sagar Society, Road No.2,  
Banjara Hills Hyderabad – 500034



**Title of Innovation:** Micropropagation of date palm. [Funded under Scheme: SBIRI]  
**Collaborating Partners:** None



**Team Members  
(including Collaborators)**  
Ashka Nikum  
Prashant Bhatt  
UrbiKundu  
Daksha Bhatt

**Address**  
Sun Agrigenetics Pvt. Ltd.  
Reign Plaza, Gotri Road,  
Gotri Road,  
Vadodara - 390021

### Brief Description of the Innovation

**Stage of development:** Commercialization

**Innovative element:** Date palm has been one of the most difficult species for micropropagation. We have been able to obtain somatic embryoids from elite local plants which will develop into plants.

**Market potential:** There is a domestic market for 5 million saplings of date palm per annum valuing Rs.5 Billion!!! Kutchh in Gujarat, Western Rajsthan, Some parts of Hariyana, Andhra Pradesh and Tamilnadu-states with land becoming saline and irrigation water has TDS above 2000 ppm are the suitable area to grow this crop.

**Risk factor:** Non availability of experimental material, extremely slow growth, low and seasonal response of explants in vitro, were the challenging aspects.

**National/societal relevance:** Micropropagation technology will make plants available for large scale for plantation, helping contribute towards the economy of country as the date palm plants are currently being imported at high costs, and local elite trees cannot be cloned.

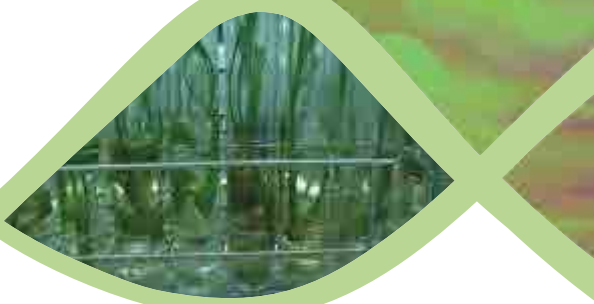
**Potential for IP generation:** In view of the fact of immense commercial importance of this innovation we will be filing International IP for the process upon completion of the project.

### PERFORMANCE EVALUATORS

**Progress Quantifier:** We have more or less achieved the major timelines of the target but are behind time schedule in last 12 months due to very seasonal nature of work.

**Plans to take the innovation further:** We have completed about 80% of project in which protocol for nondestructive method is used. Somatic embryos have been developed from elite trees We would like to take our innovation further by proposing Phase II of the project to commercialize the technology.

**Level of Satisfaction:** 7/10



**Title of Innovation:** Micropropagation of red sandalwood. [Funded under Scheme: SBIRI]  
**Collaborating Partners:** None



**Team Members  
(including Collaborators)**  
Ashka Nikum  
Prashant Bhatt  
Damyanti Patra  
Daksha Bhatt

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Gotri Road, Gotri Road,  
Vadodara- 390021

### Brief Description of the Innovation

**Stage of development:** We have completed about 80% of project in which protocol for sustained process of cloning up to shoot multiplication stage of mature 60 year old elite tree is being done.

**Innovative element (s):** Tree species are generally recalcitrant to clone from adult tree tissue. In case of Red sander such protocol is nonexistent at global level. We have developed a unique process which solves this fundamental technical problem.

**Market potential:** There is immense market potential for the saplings of Red sander for large scale plantation. The large scale illegal cutting of Red sanders by smugglers have put this species into threatened category.

**Risk factor:** Non availability of experimental material, seasonal response of explants in vitro, sudden death of multiplying cultures were the challenging aspects.

**National/societal relevance:** Micropropagation technology will make plants available for large scale for plantation and thus help in contributing towards the economy of country as the red sander wood is most expensive in the world valuing Rs. One crore per ton.

**Potential for IP generation:** In view of the fact of immense commercial importance of this innovation we will be filing International IP for the process upon completion of the project

### PERFORMANCE EVALUATORS

**Progress Quantifier:** We have more or less achieved the target within the specified period of the project of 36 months.

**Plans to take the innovation further:** We would like to take our innovation further by proposing Phase II of the project to commercialize the technology.



**Title of Innovation:** Inorganic and polymer nano-composites for micronutrient & pesticide Delivery: Boosting crop health and yield. [Funded under Scheme: BIPP]  
**Collaborating Partners:** (i) Amrita Institute of Nanosciences (ii) Rallis



## Team Members (including Collaborators)

Dr. Anand Gole  
 Dr. Subhendu Bhadraray  
 Dr. Kanwar Singh  
 Mr. Dnyaneshwar Ahire  
 Mr. Mangesh Kokate  
 Mr. Sujeet Bhoite &  
 Ms. Pradnya Aher

## Brief Description of the Innovation

**Stage of Development:** Proof-of-Concept, Scale up activity and field trials.

**Innovative element (s):** Our project is centered on using nanotechnology based delivery vehicles to supply micro-nutrients & pesticides for crops so as to boost crop health, quality and yield, reduce/control the amount of pesticides, and overall have a positive impact on the soil and plant. For this we have developed two different particle systems: a) Nano-silica based delivery vehicles; b) Inorganic complex based delivery systems; Field trials indicate that our products are far superior to benchmarks and are required in lower amounts which increase economic benefit.

**Market potential:** Micronutrient (India):1000 Cr; Microbooster: 280 Cr; Pesticide: 200-400 Cr

**Risk factor:** The small and marginal farmers, which account for a large segment of the farming community are price sensitive and lack risk taking appetite. Our efforts of providing a cost effective solution should meet the expectation of the farmers.

**National/ Societal Relevance:** Nanotechnology being an enabling technology would help to significantly enhance productivity and protect the environment by addressing issues such as: a) Increasing productivity to meet the ever increasing food demand; b) Addressing issues: deteriorated soil health, unbalanced use of fertilizers, use of organic chemicals, toxic pesticides, ground & drinking water contamination and so on; c) Low use efficiency etc

**Potential for IP generation:** Patent filed

## PERFORMANCE EVALUATORS

**Progress Quantifier:** 2nd milestone completed.

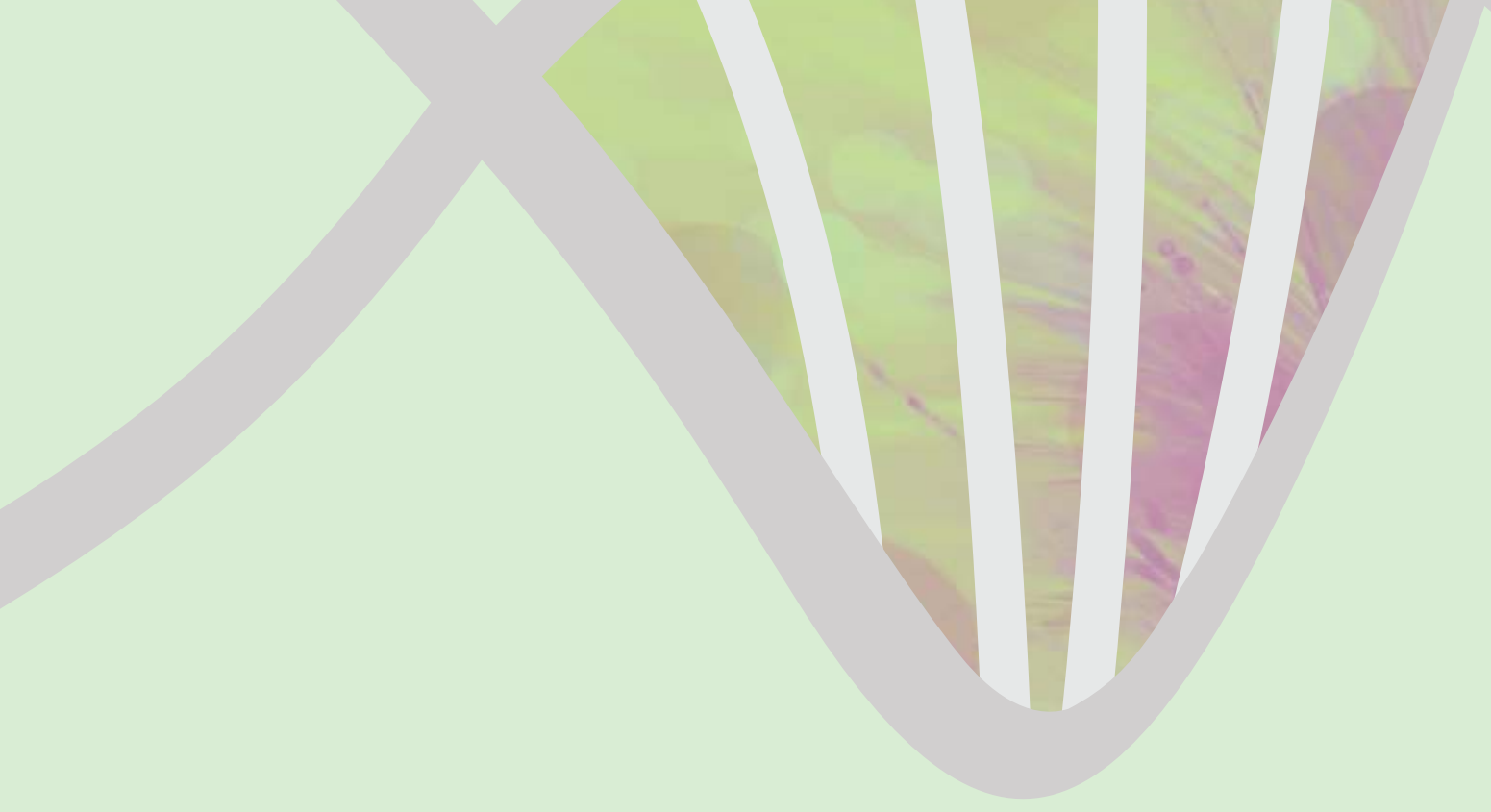
**Plans to take the innovation further:** Scale-up, multi-crop-multi-geography field trials, FCO approval.

**Level of Satisfaction:** 8/10

## Address

TATA Chemicals Ltd.  
 Bombay House  
 24 Homi Mody Street  
 Fort, Mumbai - 400 001





# BIRAC Funded Research Programmes

## **Impact Assessment Report**

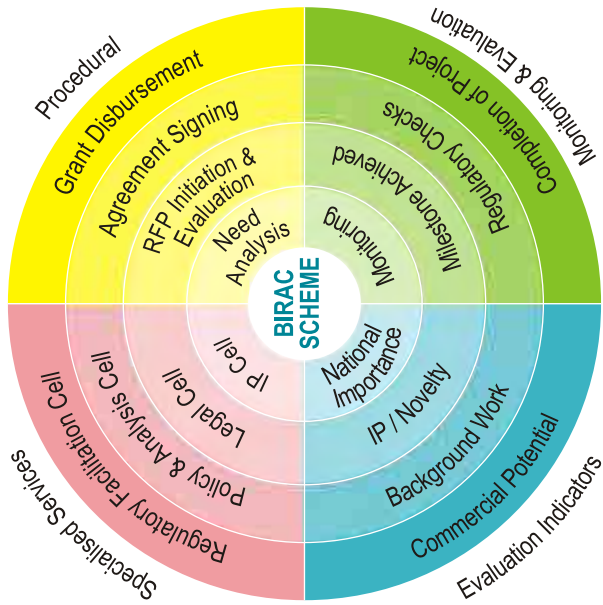
# Impact Assessment

## Bringing Change in Indian Biotech Industry through Igniting and Incubating Innovative Ideas

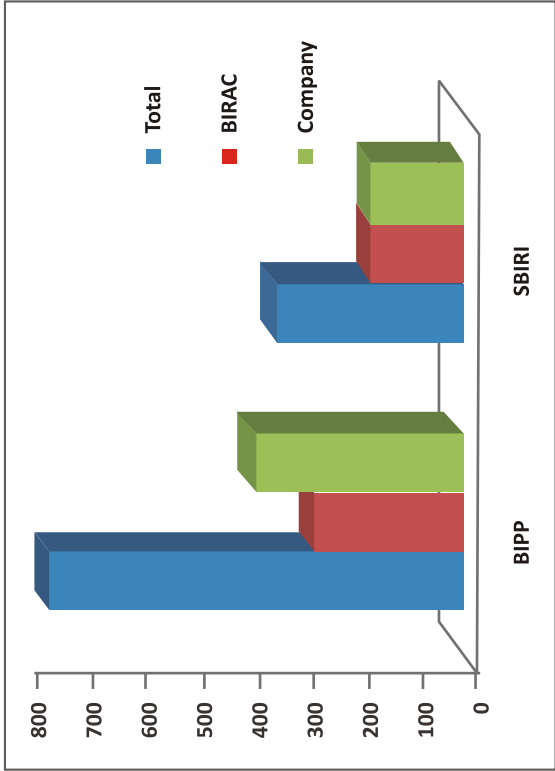
The Biotechnology Industry Partnership Programme (BIPP) and Small Business Innovation Research Initiative (SBIRI) scheme of BIRAC is an initiative of Department of Biotechnology, Government of India to foster entrepreneurship and promote SME and start ups in biotechnology sector of India.

BIRAC in its own way is bringing incremental but significant changes in the Indian biotech space. The feedbacks received from various stakeholders are encouraging. This impact analysis is an effort towards understanding the directions of the fund flow of two major schemes of BIRAC. This understanding will help in identifying the sector specific needs of the biotech industry and leads to identifying priority areas and gaps.

BIRAC intends to do the impact analysis at each and every stage through all aspects of schemes as shown

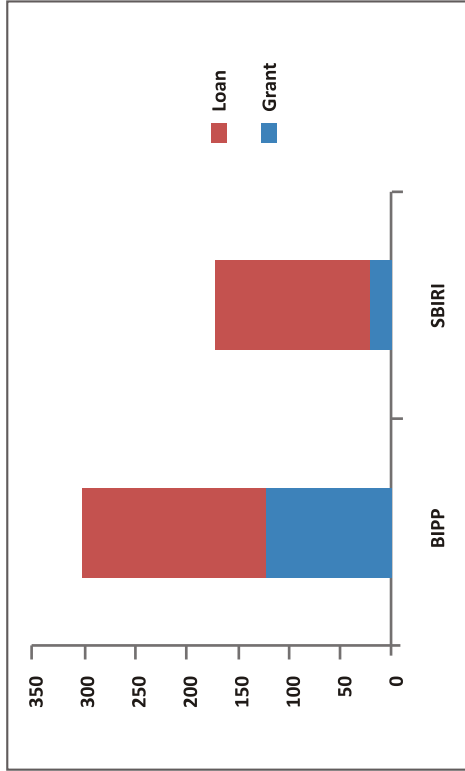


**ANALYSING THE BIRAC FUND FLOW**

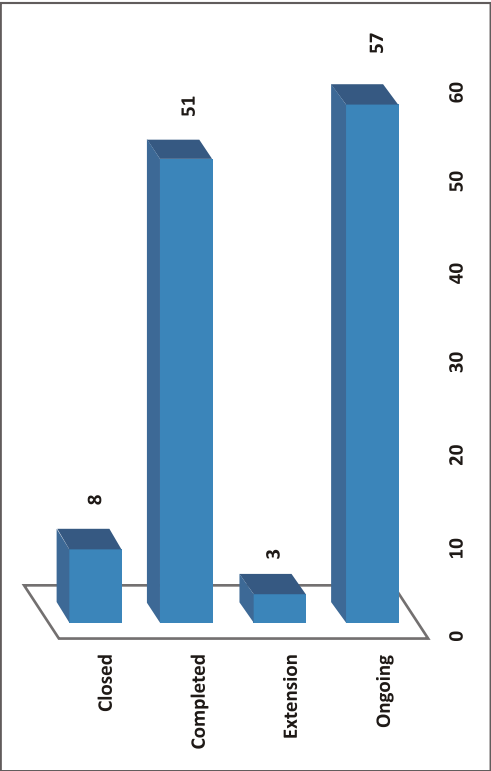


BIRAC has supported around 105 companies through SBIRI and 91 companies through BIPP with 221 projects and committed around 200 million USD through its 2 Flagship Schemes.

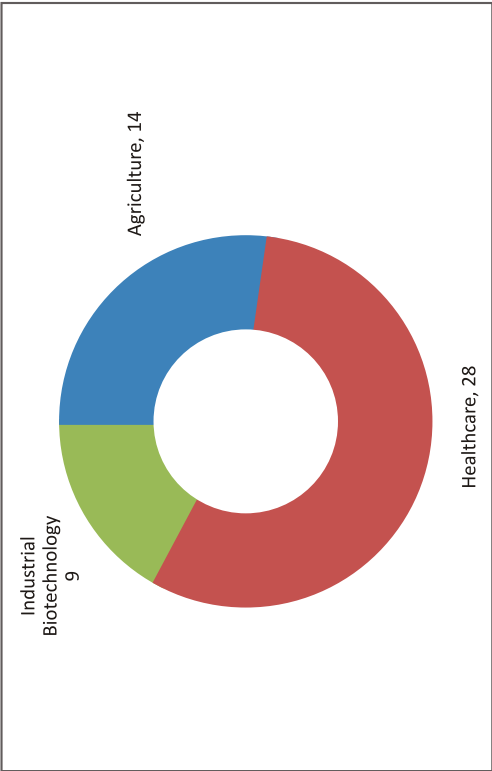
**THE FUNDS ARE DISBURSED IN THE FORM OF GRANTS AND LOANS. THE RATIO OF GRANT: LOAN IS AROUND 30 : 70**



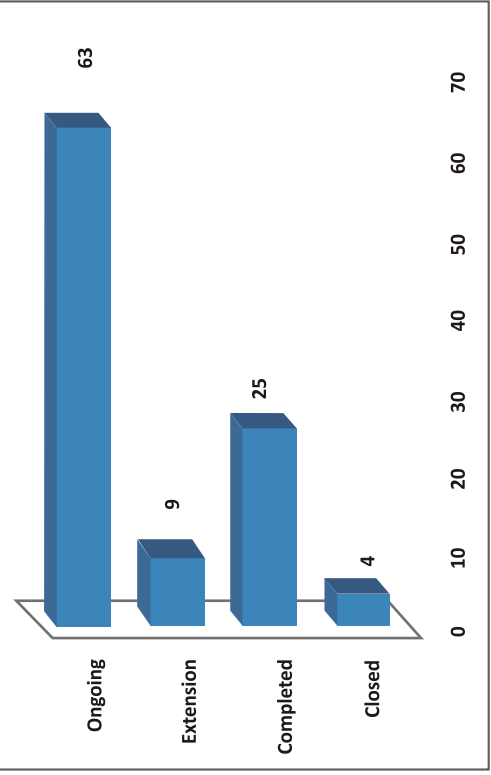
**SNAP SHOT OF STATUS OF  
SBIRI SANCTIONED PROJECTS**



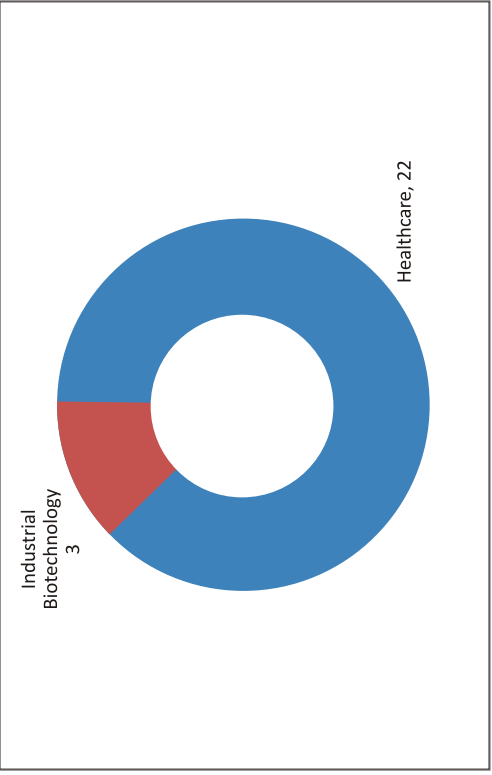
**Area wise completed projects**



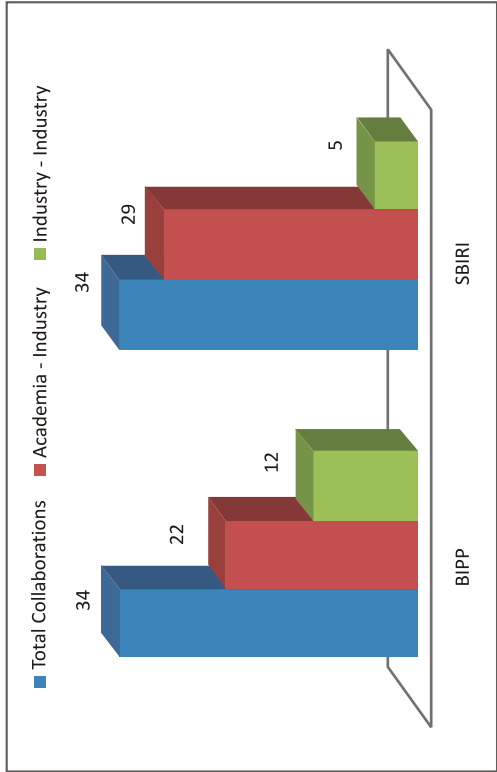
**SNAP SHOT OF STATUS OF  
BIPP SANCTIONED PROJECTS**



**Area wise completed projects**

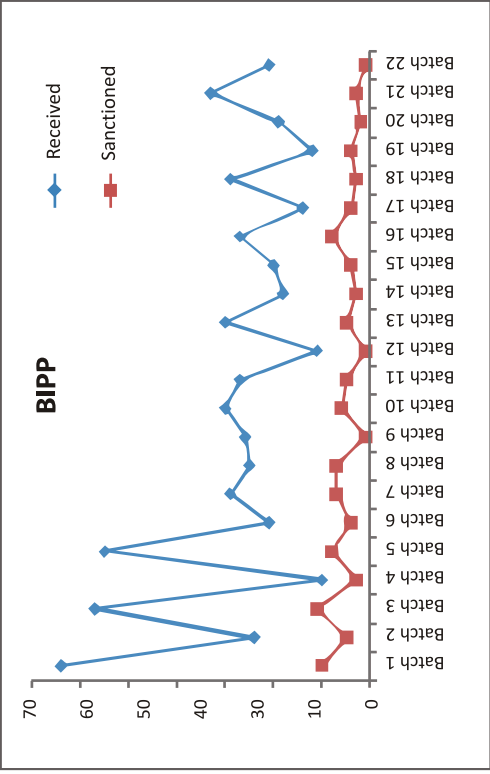
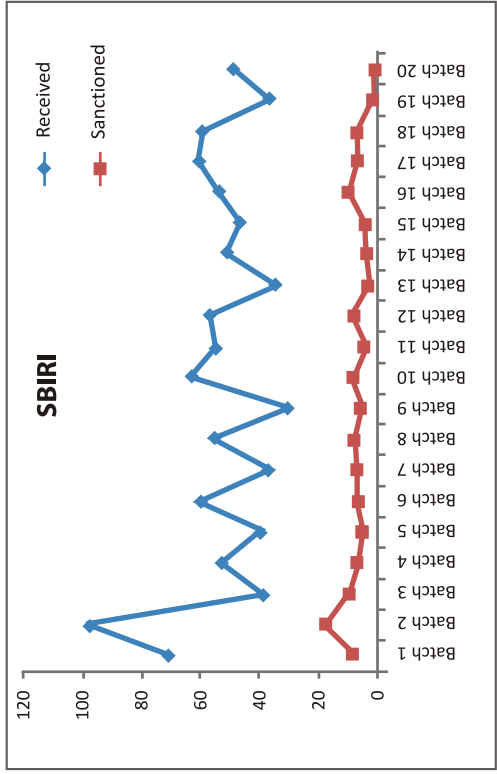


## CONNECTING THE “DOTS” – PROMOTING COLLABORATIONS



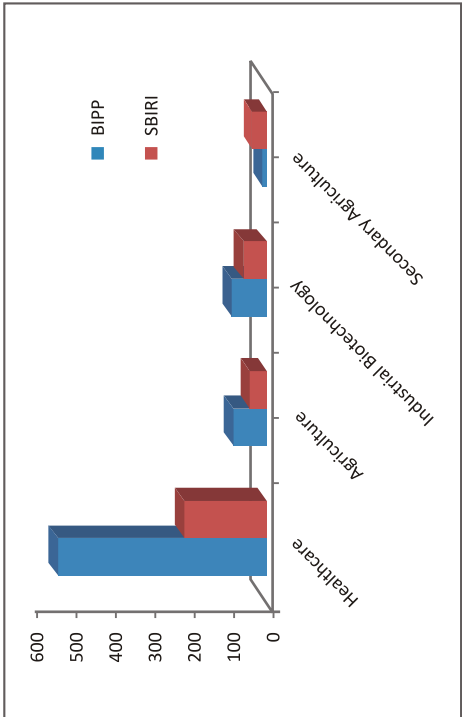
BIRAC, through its various schemes, endeavours towards bridging the gaps and decreasing the “Valley of Death”. BIRAC has promoted 68 collaborations in biotech arena

## BIRAC SCHEMES – A HIGHLY COMPETITIVE PROCESS



SBIRI and BIPP schemes of BIRAC are highly competitive – The trends highlight that an average of around 10 - 15% of the total proposals received are sanctioned for funding

## INDUSTRY WISE SUPPORT



## HEALTHCARE IS THE MAXIMUM FUNDED SECTOR FOLLOWED BY INDUSTRIAL BIOTECHNOLOGY

### Some Statistics

- Number of supported projects in Healthcare - 121
- Number of supported projects in Industrial Biotech - 39
- Number of supported projects in Agriculture - 54
- Number of supported projects in Sec Agriculture - 8

## THE METHODOLOGY OF ASSESSMENT

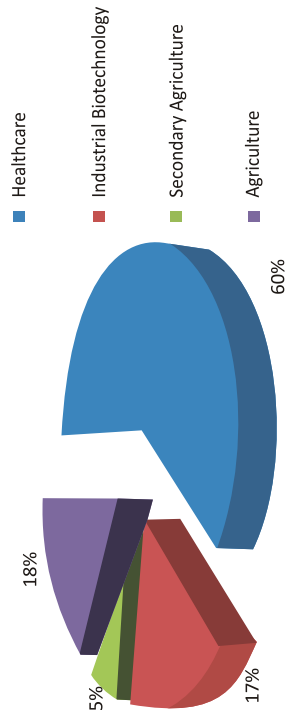
The proposal sanctioned in SBIRI and BIPP are analysed and assessed through various parameters at various stages.

This assessment of projects is done for the two schemes of BIRAC i.e Small Business Innovation Research Initiative (SBIRI) and Biotechnology Industry Partnership Programme (BIPP).

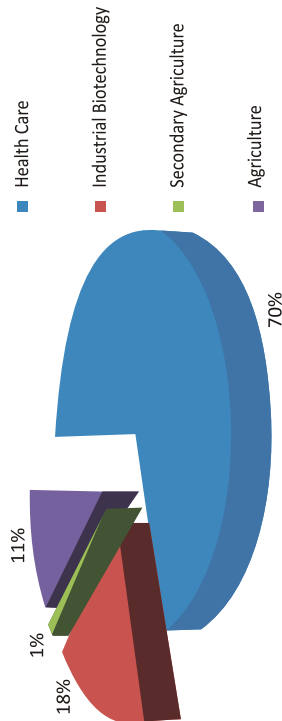
A total of 221 projects (102 from BIPP and 119 from SBIRI) were analysed on various evaluation indicators which are mentioned below; but not limited to

- The level of Innovation
- National Importance – Addressing the unmet need
- The stage of project in Product Development Cycle
- The Commercial Potential
- The Regional Density
- The current status
- Targeted Disease
- The Traits / Technology addressed
- Origin of Research / Technology
- Competitive Scale

## PERCENTAGE DISTRIBUTION OF SECTOR SPECIFIC FUNDS IN SBIRI

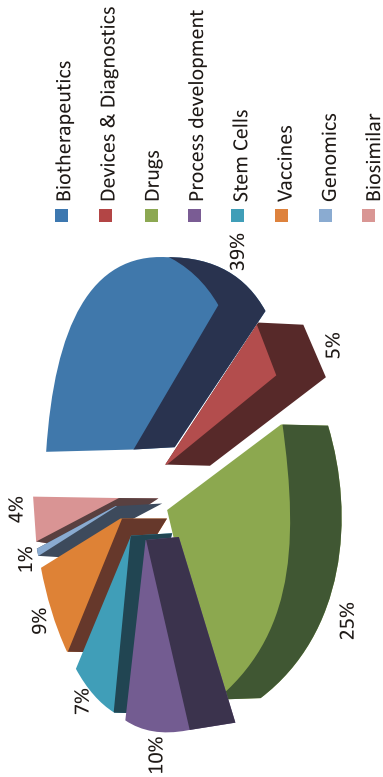


## PERCENTAGE DISTRIBUTION OF SECTOR SPECIFIC FUNDS IN BIPP

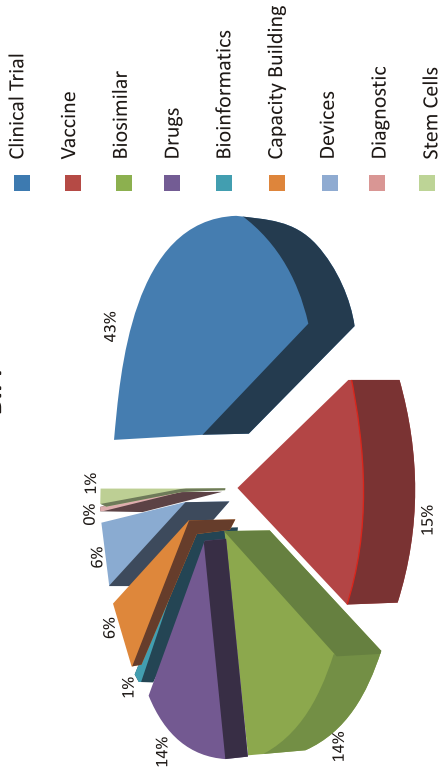


## HEALTHCARE HIGHLIGHTS

SBIRI



BIPP

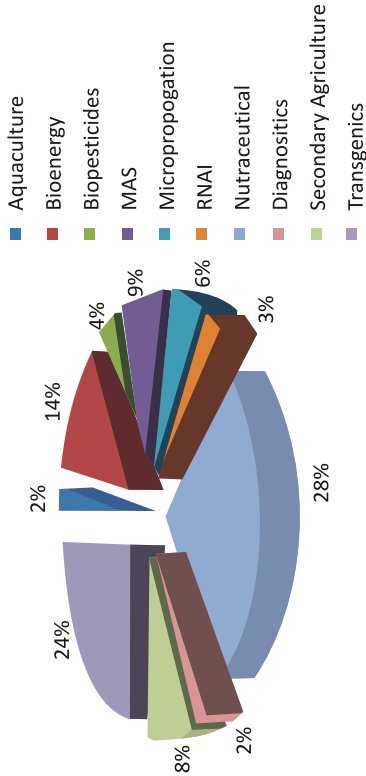


Clinical Trials sector grabs the maximum amount of Healthcare funds accounting to 43%. The heavy investments and high risk associated with clinical trials justifies their presence in BIPP scheme, which is for high risk - high investment projects. On the other hand, Biotherapeutics enjoy the maximum share in SBIRI justifying their high national importance.

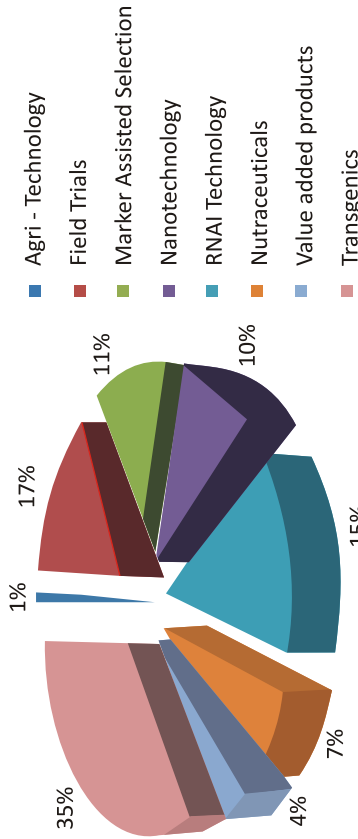
in - silico research is the upcoming sector which needs further push from funding agencies as it is a key technology to decipher increasingly available genomic data.

## AGRICULTURE HIGHLIGHTS

SBIRI - Agriculture and Secondary Agriculture



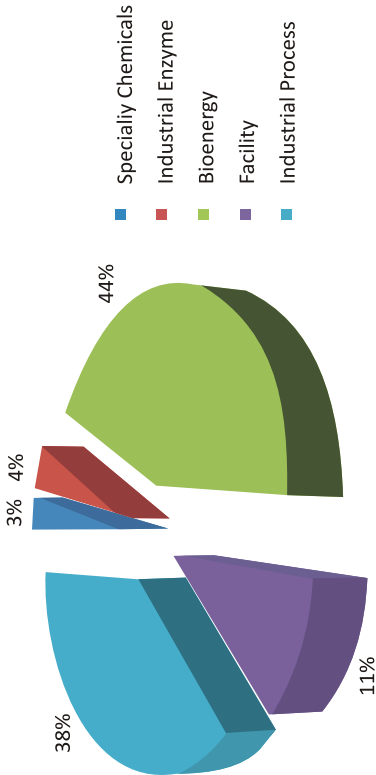
BIPP - Agriculture and Secondary Agriculture



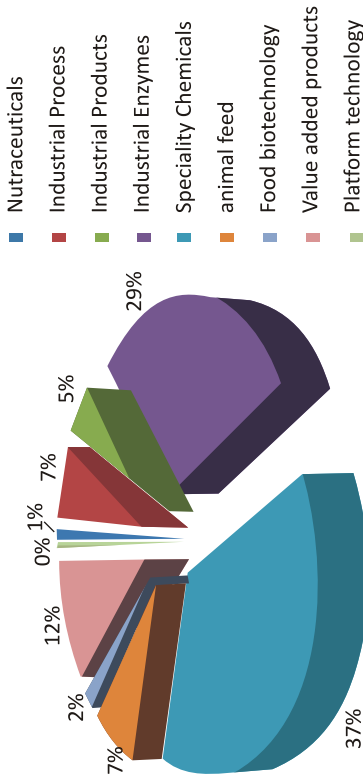
It is observed that initially BIPP supported development of Transgenic in the Agriculture sector but with the change in Regulatory Climate an increased funding in other technologies like Mass, RNAi, Bio-pesticides is reflected in both BIPP and SBIRI.

# INDUSTRIAL BIOTECHNOLOGY HIGHLIGHTS

BIPP



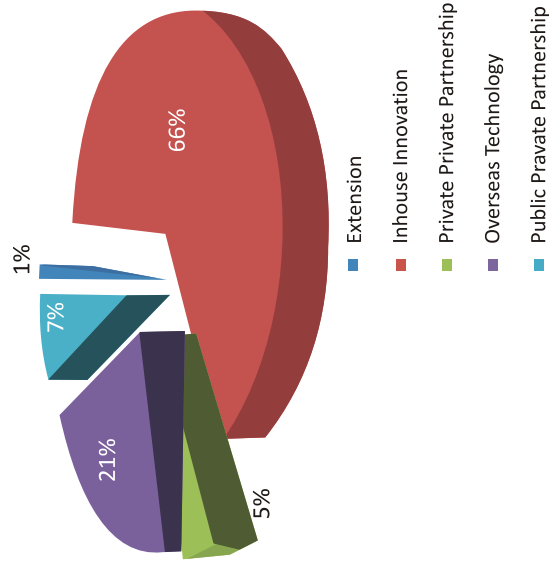
SBIRI



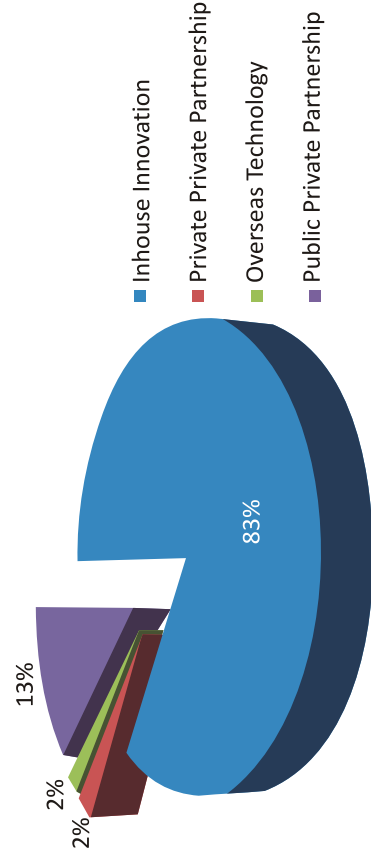
The Bio-energy sector has received the major (44%) of Industrial Biotechnology funding in BIPP whereas, the SBIRI scheme has supported the Specialty Chemicals and Industrial Bio-enzymes with 37% and 29% share respectively.

# ORIGIN OF TECHNOLOGY

BIPP



SBIRI



The Technology origin describes that the innovation /Technology addressed through the proposal is initiated from Industry In-house efforts, Academic Research transferred to Industry, Imported technology adapted to Indian needs or collaboration between two different industries

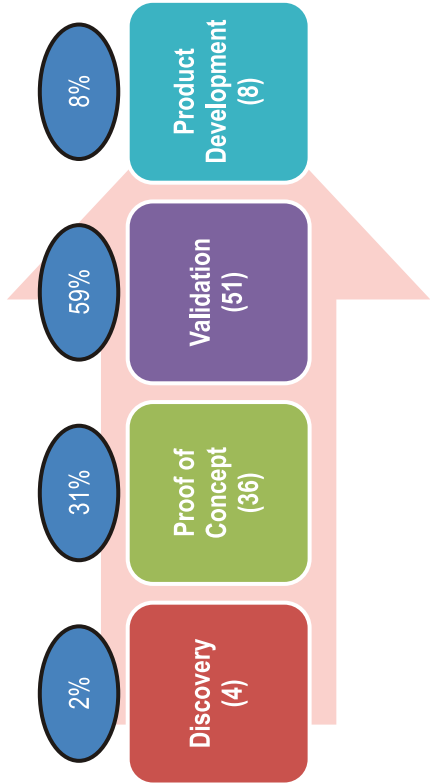
## PROMOTING PUBLIC PRIVATE PARTNERSHIP

66% of committed funds in BIPP are targeting In-house Innovations from Industries and 83% of funds in SBIRI projects are for In-house Innovations.

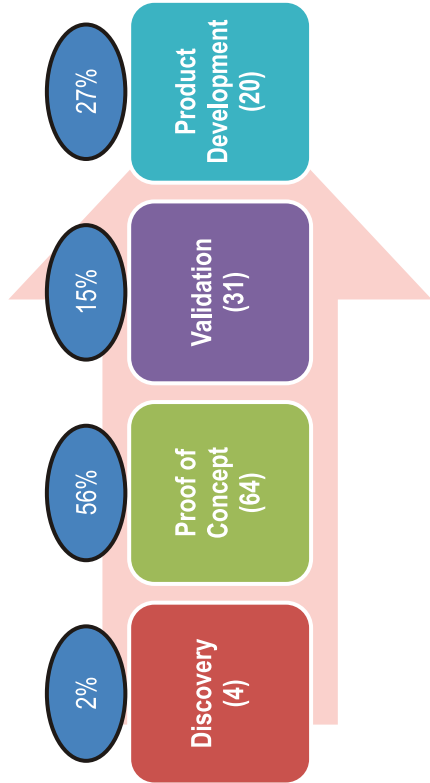
21% of BIPP funds are committed for bringing nationally imported overseas technology to Indian sub-continent.

### FUND FLOW AS PER STAGES OF PRODUCT DEVELOPMENT

59% of BIPP committed funds accounting to 51 projects are for Validation of the Products or Processes. The risk and amount associated with projects at validation stage is high reflecting and strengthening that the BIPP scheme is for high risk projects.

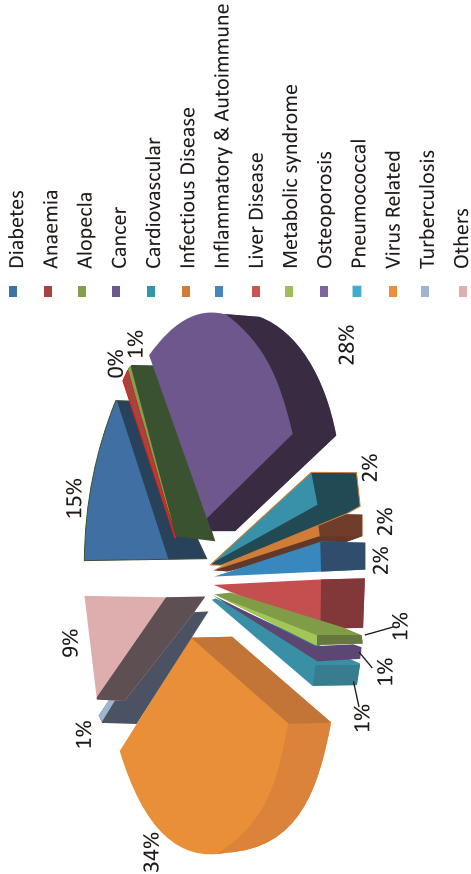


56% of SBIRI committed funds accounting for 64 projects are for Proof of Concept. This reflects that the SBIRI scheme is primarily for establishing the Proof of Concept for the initial stages of the product development cycle.



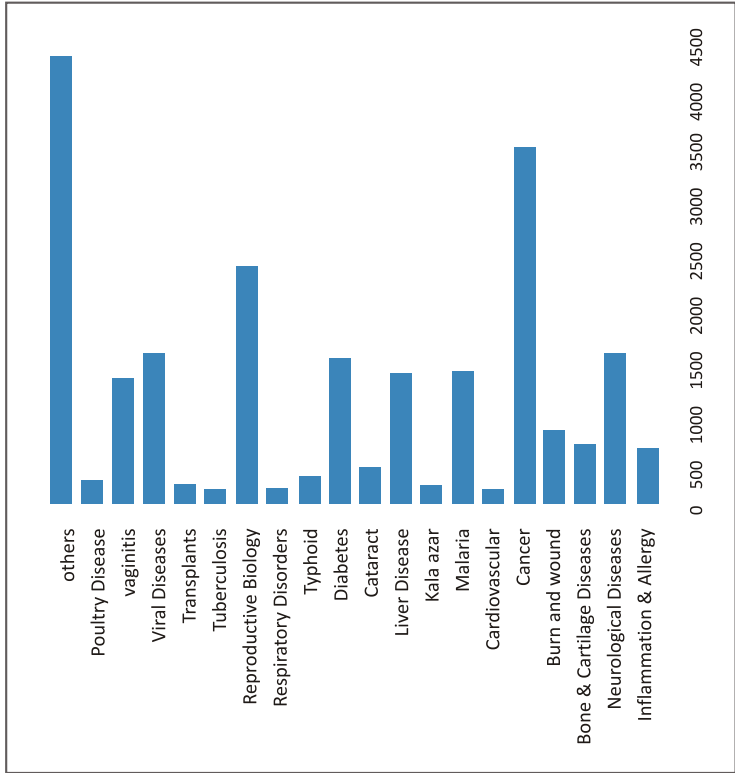
Both the schemes reflect that, gap exists at the discovery stage of the product development cycle. The Gap is addressed through the Biotechnology Ignition Grant (BIG) scheme of BIRAC.

### FUNDING TRENDS IN BIPP HEALTH CARE – DISEASE WISE



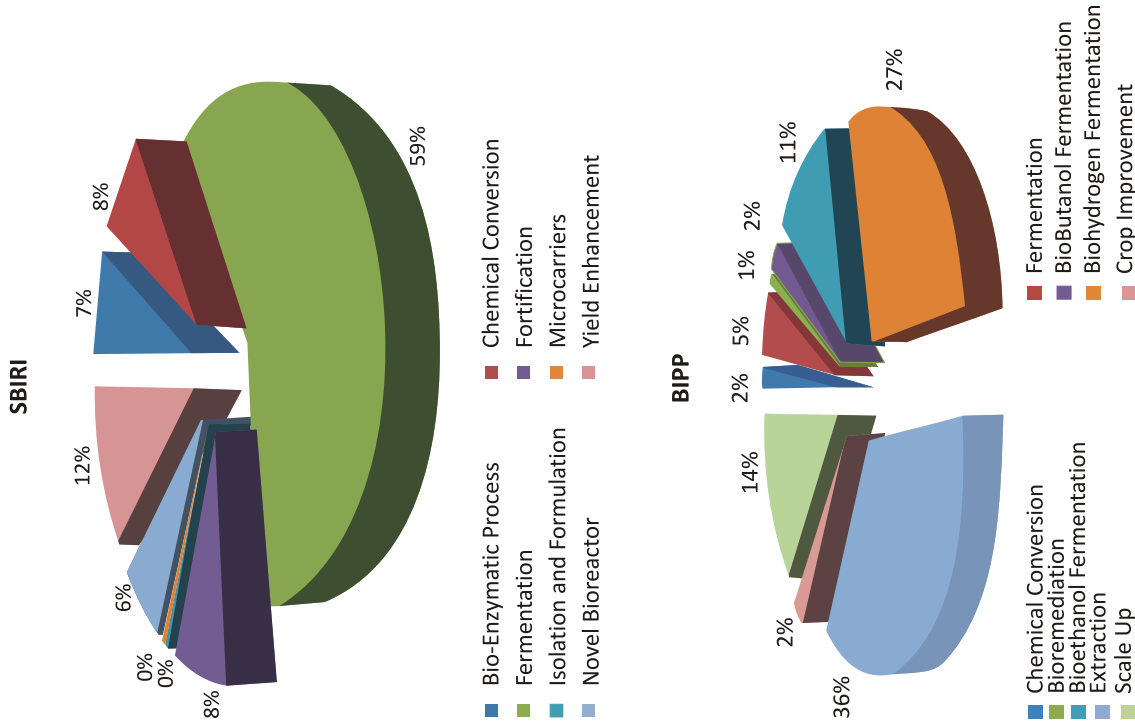
- Virus Related Diseases grab the maximum, 34% of BIPP funding committed for Healthcare sector.
- 28% of Funding is going for research and development of Cancer related disorders like Cervical, Ovarian, Gastric and Lung Cancer
- 15% funds allotted for Diabetes which is highlighting the disease spread in India.
- The Tuberculosis has received only 1% of funds. Looking at the disease prevalence in India, the support in this sector should be increased.
- “others” category share 9% of funds reflecting platform technology which can be used for one or more diseases

## FUNDING TRENDS IN SBIRI HEALTH CARE – DISEASE WISE



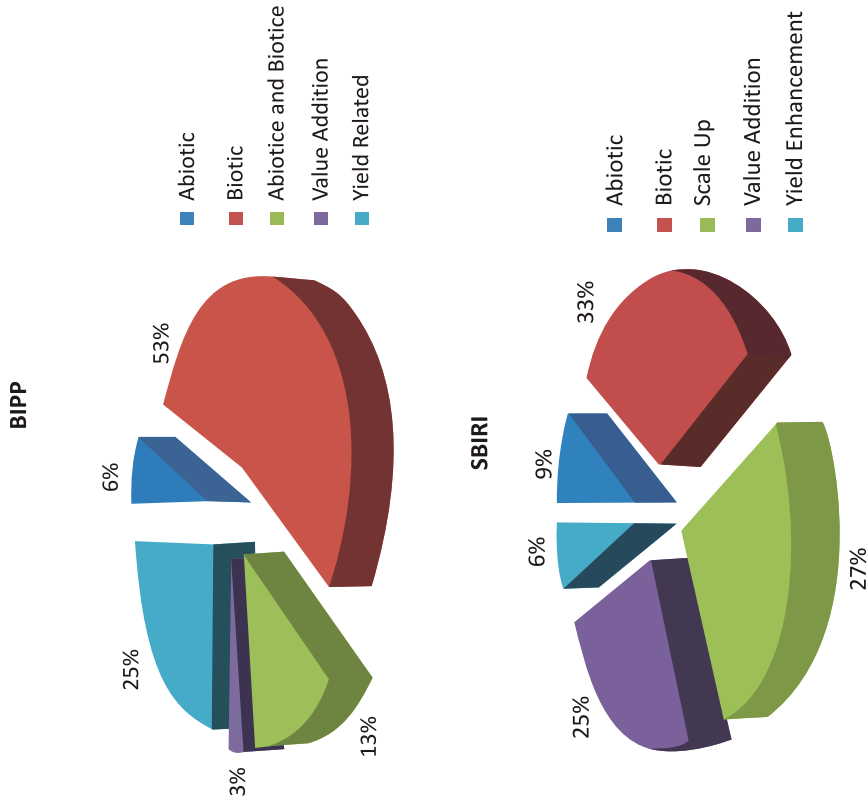
- The portfolio of diseases supported by SBIRI scheme is broad. The "others" section grabbing the highest 21% share is for platform technologies which can be used for more than one diseases
- The 16% funds are committed for Cancer related disorders. This signifies the increase in the number of cancer cases in India.
- 11% funds are used for Reproductive biology studies.
- The Disease portfolio also includes some Neglected tropical diseases like Kala azar which is the unmet need of the nation.

## FUNDING TRENDS IN INDUSTRIAL BIOTECH – PROCESS WISE



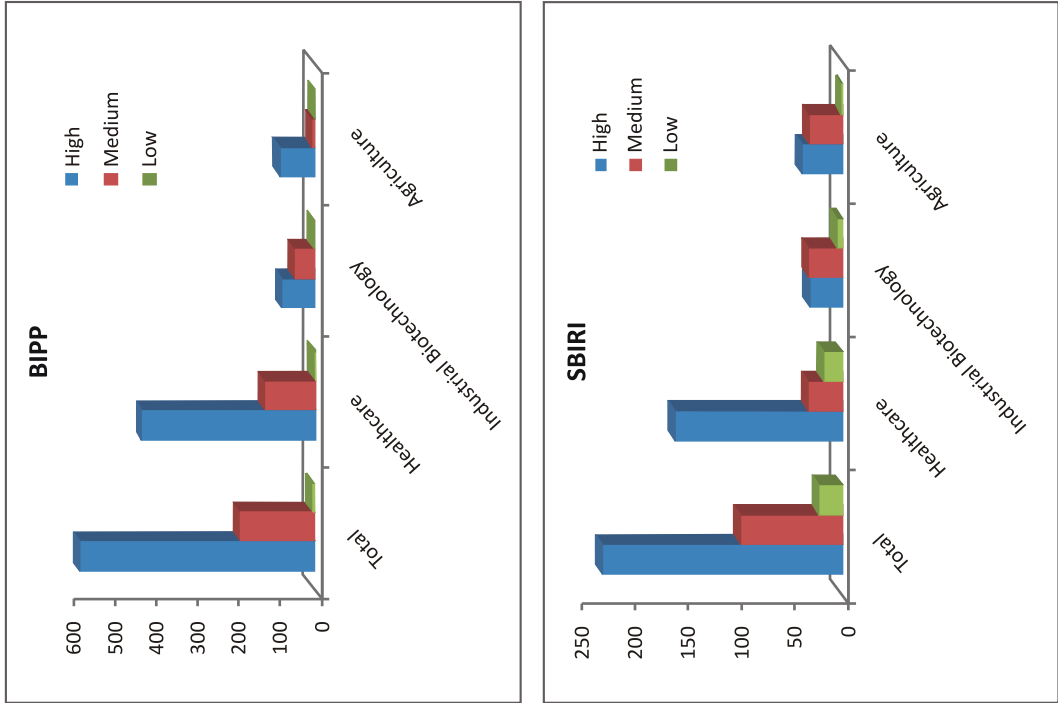
- 40% of BIPP committed funds for IB Sector are in the Bioenergy space. Comprising of 27% in Biohydrogen, 11% in Bioethanol and 2% for Biobutanol fermentation based processes
- The maximum 36% funds are committed for Oil Extraction processes through waste product.
- 14% for funds are committed for strengthening the infrastructure capacities of this sector
- Fermentation funds in BIPP i.e 5% is committed for projects like enzyme, rare sugar and Biopolymers production
- 59% of SBIRI funds are committed for fermentation processes like Industrial enzyme, DHA,  $\beta$ -Carotene production.

## FUNDING TRENDS IN AGRI & SECONDARY AGRICULTURE – TRAIT WISE



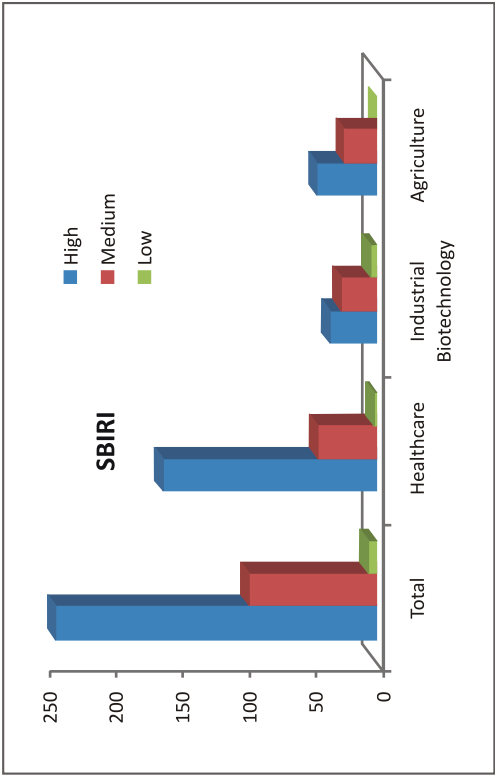
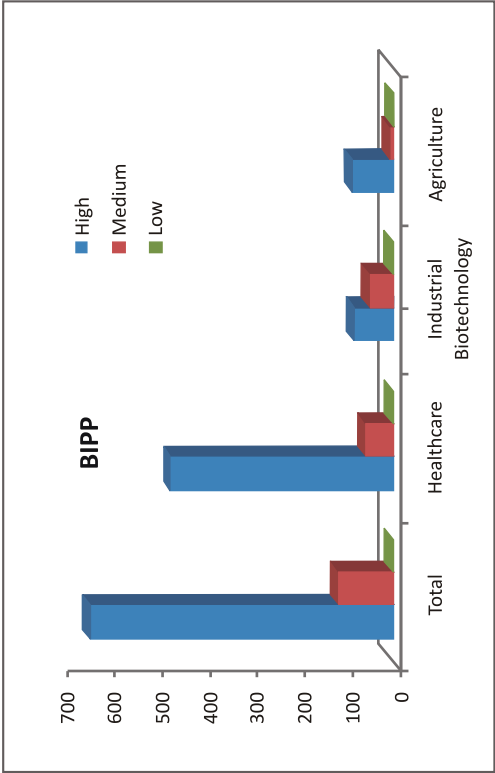
- Major funding in Agriculture sector are committed for encouraging resistance in crop plants for Biotic stress, where 53% of funds is in BIPP whereas 33% are in SBIRI.
- 25% of BIPP funds are going into yield related traits showing the need of yield enhancement.
- The SBIRI scheme is supporting value addition and scale projects reflecting the upcoming ready technologies in SME sector

## NATIONAL IMPORTANCE - SECTOR WISE



The statistics highlights that the projects funded under the BIRAC schemes are of High National Importance. The Healthcare being the highest funded sector has the highest number of nationally important projects, few of which are development of Rotavirus, Pneumococcal, JE, HPV and Influenza Vaccines.

### COMMERCIAL POTENTIAL - SECTOR WISE



The maximum projects funded by BIRAC are of High Commercial Potential. Few commercially important sectors supported by BIRAC include Diagnostic Kits and Devices, Biosimilar, varieties developed by marker assisted selection and second generation Ethanol production.



# Summing up

Though these pioneering schemes, BIRAC has supported 221 projects and has committed US \$200 million. It is interesting to note that the industry has contributed significantly to the projects thus making the two schemes a true representative of public-private partnership. The impact assessment not only identifies the priority areas that BIRAC has focused on but also provides salient information regarding the specific biotechnology sectors that need further assistance.

## Overall Assessment

- The highest amount of support has been to healthcare sector (70% & 60% for BIPP & SBIRI respectively) thus mirroring the industry where biopharma (including healthcare) holds more than 60% of revenues. Other areas such as bioagri, industrial and bioinformatics have received proportionate funding.
- Support to both BIPP and SBIRI have supported a healthy mix of start ups, SME and large companies.
- More than 80% of projects supported were either for validation or proof-of concept. The statistics also highlight a significant difference between BIPP & SBIRI. In BIPP, 59% of projects supported were for validation studies while for SBIRI, 56% of the projects supported were for proof-of-concept.
- Both the schemes are true representative of PPP model. In both BIPP & SBIRI the contribution of industry for the project is equal or more thus highlighting the appetite for R&D.
- Another R&D statistics is that in-house technology innovation has been supported by BIPP (66% of funds committed to in-house innovation) and SBIRI (83% of funds committed to in-house innovation). These are early indicators of high risk appetite for innovation by Indian biotechnology firms.

- BIRAC's funding schemes have promoted joint R&D and collaboration of industry and academia which bodes well for bridging the industry-university gap in the country. This is reflected in the fact that in BIPP out of 102 projects, 34 are collaborations either between industry-industry or industry academia. Similarly in SBIRI, from the total number of 120 projects, 34 are collaborative projects. Interestingly, in SBIRI, out of the 34 collaborative projects, the proportion of academia-industry collaboration is five times than that of industry-industry collaboration. This indeed is a reflection of the facilitative environment that BIRAC's flagship programmes provide for collaborative R&D.

## BIRAC's support for Healthcare

India faces several challenges concerning the health of its citizens. Both chronic conditions such as cancer and diabetes as well as infectious diseases such as malaria and TB cause mortality and morbidity. Both BIPP and SBIRI support a wide range of healthcare projects that span clinical trials to diagnostics, devices and stem cells. Clinical trials, biotherapeutics and biosimilars remain the highly supported segment. Among disease areas both SBIRI & BIPP show that cancer projects have garnered considerable support (28% of funds for BIPP & 16% in SBIRI for cancer). In BIPP viral diseases have been significantly supported (34% of funding).

## BIRAC's support for Agriculture and Secondary Agriculture

The agriculture & secondary agriculture sector is very important for the fact that it employs the largest section of the society and needs injection of new technologies for increasing productivity such that for a growing population food security is not compromised. Agriculture and secondary agriculture receives broad support across several technologies from transgenics to neutraceuticals to name a few. It can be noted that technologies other than transgenics such as MAS, RNAi and biopesticides have been funded highlighting BIRAC's commitment to fund cutting edge technologies which will keep India at the forefront of global agricultural R&D.





## BIRAC's support for Bioindustrial sector

Bioindustry sector is one of the pillars of a bioeconomy. Major R&D projects in this sector aim at reducing India's energy dependence by converting biomass into varied substrate for downstream energy sources including, for example, bioethanol and isobutanol. Industrial enzymes also contribute to several processes from pharmaceuticals to textiles and it has also received significant support from BIRAC.

Both the flagship schemes of BIRAC contribute immensely to the goal of deriving bioenergy from varied biomass sources as reflected in the greater percentage of support this area receives. Specialty chemicals too have received considerable support. It is also to be noted that infrastructure support is a key element of BIRAC support.

## The Future

BIRAC is committed to usher in an Indian bioeconomy and help accelerate Indian biotechnology sector to reach US \$100 billion by 2025. The compendium provides a snapshot of some of the innovations that BIRAC has supported as well as analyses the impact it has on the sector and the country as a whole. The two flagship schemes BIPP and SBIRI have over the years identified cutting edge innovations that have been set along the affordable product development pipeline in all areas of biotechnology. The guiding principle for the programmes has been to support high risk innovations that are nationally and globally important. BIPP and SBIRI have now been complemented by other effective programmes such as Biotechnology Ignition Grant (for fostering idea to proof-of-concept), Bioincubator Support Scheme (BISS), Grand Challenges Initiative and SPARSH (for social innovation in biotechnology) to name a few.

As BIRAC builds internal competencies and capabilities, it will endeavour to strengthen and modify existing programmes as well as initiate new programmes that will reflect the innovation needs of the country. BIRAC will continue to ignite, innovate and incubate while playing the role of a connector and a catalyser.

# List of Companies Funded under BIRAC Funding Schemes

ANNEXURE

Biotechnology Industry Partnership Programme (BIPP)

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
1.	AP Organics Pvt. Ltd., Ludhiana, Punjab	—	Project on Value Addition including potential nutraceuticals from derivatives of Rice
2.	Abexome Biosciences Pvt. Ltd., Bangalore	--	Establishment of invitro pharmacological assay platform for biosimilars
3.	Abhay Cotex Pvt Ltd., Jalna	--	Single step Extraction of cotton seed with miscella refining
4.	Achira Labs Pvt. Ltd.	--	Electrophoretic pre-concentration to enable the fluorescence-based detection of ultra-low concentrations of analytes in human sera at the point-of-care
5.	Advanta India Limited, Hyderabad	--	RNAi and other cutting edge technological interventions to develop insect pest, diseases and viruses tolerant tomato hybrids for Indian and International market
6.	Advanta, Hyderabad	--	Multistacking genes to develop engineered rice with enhanced drought and multiple disease and pest resistance
7.	Agada Medical technologies Pvt. Ltd., Chennai	--	Percutaneous Aortic Valve Technology
8.	Amar immunodiagnostics Pvt. Ltd., Hyderabad	--	Immunodiagnostic kits for detection of autoimmune diseases
9.	Amrita Therapeutics Limited, New Delhi	National Institute of Immunology, New Delhi	Identification and development of promiscuous anticancer compounds from microorganism
10.	Anil Ltd., New Delhi	National Chemical Laboratory, Pune	Development of Value added Corn Steep Liquor and Powder suitable for food and fermentation Industry up to Pilot scale (1TPD)
11.	Ankur Seeds Pvt. Ltd., Nagpur	University of Delhi, South Campus	Third generation RNAi for engineering Tomato leaf curl (ToL CV) and tospovirus (GBNV) resistance in tomato
12.	Anthem Biosciences Pvt. Ltd. & Cellworks Research India Pvt. Ltd. Bangalore	--	Ketoreductases - Whole Cell Biotransformation For Chiral Chemistry
13.	ARA Healthcare Ltd, Gurgaon	--	Development And Pilot Scale Production Of ANTI-TNF-α Antibody scFv For Treatment Of Inflammatory Diseases
14.	Avesthagen Limited, Bangalore	--	Development of Self-glucogenic Pearl Millet adapted for marginal lands
15.	Axxonet System Technologies	--	Automated Portable Epilepsy-EEG system
16.	Bejo Sheetal Seeds Pvt. Ltd, Jalna	--	Development of 'Herbicide & Stress tolerant' transgenic Onion
17.	Bharat BioTec, Hyderabad	CMC Vellore; KEM Hospital, Pune; THSTI	Phase III Testing and Evaluation of Safety and Efficacy of Oral Rotavirus Vaccine Candidate 116E

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
18.	Bharat Serums and Vaccines Limited, Mumbai	–	Process Development and scale up of a commercially viable manufacturing process of an essentially similar therapeutic peptide based implant with anti cancer properties and development of a technology platform for implant based sustained release formulations incorporating therapeutic peptides/ recombinant proteins
19.	Bhat Biotech India Pvt. Ltd., Bangalore	–	Design and Expression of humanized antibodies against soluble Interleukin-6R, soluble gp130 in Bacteria and Animal Cell lines
20.	Bigtec Private Ltd. Bangalore	–	Assay validation enabling infectious disease detection at point-of-care using bigtec's handheld microPCR
21.	Biocon Ltd., Bangalore	–	Open label randomized, multicentric studies to compare safety and efficacy of recombinant insulin Aspart-Biphasic and regular with Novolog mix 70/30 and Novorapid in T1DM and T2DM patients
22.	Biocon Ltd., Bangalore	–	A Multicenter, Randomized, Double-Blind, Placebo Control Study of IN-105 tablets [oral insulin] in Patients with Type 2 Diabetes Mellitus who have inadequate Glycemic Control on Optimal doses of Extended Release Metformin Tablets.
23.	Biological. E, Hyderabad	–	A multicentric, parallel, randomised (2:1) open label phase III clinical study to evaluate the immunogenicity and safety of BE's inactivated JE vaccine in healthy ?1 to < 3 year old Indian subjects in comparison with purified inactivated JE vaccine (IXIARO) of intercell- An noninferiority study
24.	Bioseed Research India Pvt. Ltd.	–	Identification of QTL(s) for drought tolerance and their introgression in elite cultivars of rice.
25.	Bioseed Research India Pvt. Ltd., Hyderabad	ICGEB, Bew Delhi	Development of rice hybrids with improved drought and salinity stress tolerance
26.	BPCL	The Energy & Resources Institute, New Delhi	Development of Process Knowhow for Butanol Production from lignocellulosic biomass
27.	Cadilla Pharmaceuticals Ltd., Ahmedabad	–	Clinical Development of Influenza Vaccines
28.	C-CAMP, Bangalore	–	Flow Anlayzer
29.	Celestial Biologicals Ltd, Ahmedabad	–	Scale-up of Plasma Fractionation Facility for High Value Products
30.	Chromous Biotech Pvt. Ltd., Bangalore	–	Multiplex Fast-PCR based diagnosis and prognosis of tuberculosis
31.	Chromous Biotech Pvt. Ltd., Bangalore & IARI	IARI, New Delhi	"Multiplexed Fast-PCR based detection kit for a group of viruses affecting potato in India"
32.	Clonz Biotech Pvt Ltd., Hyderbad	–	Production of Ranibizumab - a recombinant humanized Anti VEGF monoclonal antibody fragment (recombinant huFab V2) expressed in Hansenula Polymorpha.

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
33.	Connexios Life Sciences	--	Lead selection and preclinical development of a novel 11-hydroxysteroid dehydrogenase beta 1 inhibitor as an oral anti-diabetic to treat Type 2 Diabetes.
34.	Crystalin Research Pvt. Ltd., Hyderabad	--	Clinical trials of novel anticancer drug cocrystal
35.	Design Innova, Delhi	ICGEB, New Delhi	Design and development of an affordable Fluorescence Reader for Point-of-care diagnostics
36.	Frontier Lifeline Private Limited	--	Porcine Pulmonary Xenograft as a Versatile Conduit in Cardiovascular Surgery
37.	Gennova Biopharmaceuticals Limited, Pune	--	State of art cGMP production facility meeting regulatory requirement for production of recombinant Bio-therapeutics
38.	Gennova Biopharmaceuticals Limited, Pune	--	Biosimilar Interferon beta 1a: process development
39.	Gennova Biopharmaceuticals Limited, Pune	--	Development of a cost effective prophylactic & Therapeutic Recombinant Human Papillomavirus vaccine
40.	GEO Biotechnologies India Pvt Ltd, Bangalore	CIMMYT, Hyderabad	Association Mapping and Whole Genome Marker Assisted Recurrent Selection for Development of Abiotic Stress Resilient Maize
41.	Imgenex India Pvt. Ltd., Bhubaneswar	--	Development of High Expression Plasmid vectors for Production of Biosimilar Herceptin and Other Recombinant Proteins and Antibodies.
42.	Inbiopro Solutions Pvt Ltd, Bangalore	--	Interferon Beta 1 b Process development
43.	Incozen Therapeutics Pvt. Ltd., Hyderabad	--	Discovery and development of potent, selective and novel c-Met Kinase Inhibitors in cancer
44.	India Glycols, Kashipur	--	Setting up a 10 ton Lignocellulosic biomass/day processing plant to produce about 3000 Litre ethanol/day
45.	Intas Biopharmaceuticals Ltd., Ahmedabad	--	Discovery and Development of Potent, Selective and Novel c-Met Kinase Inhibitors in Cancer
46.	Intas Biopharmaceuticals Pvt. Ltd. Ahmedabad	--	Creation of a state of art integrated facility for high end structural and functional characterization of protein therapeutics and peptides
47.	Janacare Solutions Pvt. Limited, Delhi	AIIMS, New Delhi; Narayana Hrudyalaya City	DXPhone
48.	Jk Agri Genetics Ltd., Hyderabad	--	Development of Bt-rice with two cry genes
49.	Kaveri Seed Company Ltd., Hyderabad	--	Marker-assisted dissection of genetic basis of yield and improving yield potential under drought stress in Maize
50.	Kaveri seed Company Ltd., Hyderabad	--	Development of biotic stress resistance rice through conjunct use of Bio- and Hybrid technologies

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
51.	Krishidhan Seeds Private Limited, Jalna	ICRISAT, Hyderabad	Genomics assisted accelerated product development of high yielding pigeonpea hybrids
52.	Kumar Organics Products Limited, Bangalore	–	Sustainable and versatile microbial polymers: a bio-based prospect for India
53.	Lifecare Innovations Pvt. Ltd., Gurgaon	–	Phase I clinical Trial with poly (lactide-co-glycolide) (PLG) nanoparticles encapsulating antitubercular drugs (rifampicin, isoniazid and pyrazinamide)
54.	Maharashtra Hybrid seeds company Limited	–	Development of sucking insect pest tolerant rice and cotton
55.	Maharashtra Hybrid seeds company Limited	–	Stress tolerant rice
56.	Merkel Haptic Systems Private Limited, Chennai	–	Hi-Fidelity Affordable Mannequin for Effective CPR (Cardio pulmonary Resuscitation) Training
57.	Metahelix Life Sciences Private Ltd., Bangalore	–	A proposal for funding of deregulation trials of transgenic rice events expressing Metahelix synthetic Cry1C, Cry1Ac and Cry1Ab genes for tolerance to rice yellow stem borer, <i>Scirpophaga incertulas</i>
58.	Metahelix Life Sciences Private Ltd., Bangalore	–	Deregulation trials phase I of transgenic maize events expressing Metahelix Synthetic Cry1C, Cry1Ac and Cry1Ab Genes for tolerance to stem and cob borers
59.	Mitra Biotech Pvt Ltd, Bangalore	Anthem Biosciences, Bangalore	Development of PAT-1102, a novel HDAC inhibitor for the treatment of cancer
60.	Mother Dairy Fruit and Vegetable Pvt. Ltd., Delhi	University of Delhi, South Campus	To conduct confined field trials and biosafety studies on genetically engineered Brassica juncea
61.	MykoTech Private Limited, Goa	–	Enhanced production of extracellular melanin from various fungal sources for protection against UV and gamma radiations
62.	Nagarjuna Fertilizers & Chemicals Limited, Hyderabad	–	Development of Technology Platform for Rare Sugar Production
63.	Nagarjuna Fertilizers & Chemicals Limited, Hyderabad	–	Transformational Technology Platform Development for Biological Hydrogen
64.	Natural Remedies Pvt. Ltd.	–	Scale-up facilities for the production of phytochemical reference substances from Indian medicinal plants of national relevance as a business model
65.	Navya Biologicals Pvt Ltd., Pune	–	Development of novel intensified technology platform for production of low cost MAbs
66.	Nirmal seeds Pvt Ltd, Jalgaon	University of Delhi, South Campus	Development of Viral resistant okra using RNAi approach
67.	Nirmal Seeds Pvt., Jalgaon	–	Development of nutritionally improved mustard (Brassica juncea) varieties/hybrids having low erucic acid and low glucosinolate content using marker assisted selection

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
68.	Optra Systems Pvt. Ltd., Pune	--	ONCOSCAN - Digital Oncopathology Slide Scanner
69.	Panacea Biotec Ltd., Delhi	--	Development of a H1N1 pandemic influenza vaccine
70.	Panacea Biotech. Ltd., Delhi	--	Development of Novel peptide based topical gel for the treatment of Alopecia
71.	Panacea Biotech. Ltd., Delhi	--	Development of safe and highly efficacious 13 -valent pneumococcal conjugate vaccine against Streptococcus pneumoniae infections
72.	Panacea Medical Technologies Pvt Ltd	--	Development of Flat Panel Computed Tomography (FPCT) machine
73.	Perfint Helthcare Pvt.Ltd., Chennai	--	Solution for planning, execution and confirmation of targeted tumor ablation therapy
74.	Persistent Systems, Pune	--	SanGeniX: A comprehensive Next Generation Sequence (NGS) data analysis solution
75.	Phyto Biotech Pvt. Ltd.	--	Novel technology for Microbial Production of Paclitaxel, an anticancer drug
76.	Praj Industries Ltd., Pune	--	Lignocellulosic Biomass to ethanol technology: Stimultaneous Saccharification and Fermentation
77.	Ras Life Sciences Pvt. Ltd., Hyderabad	--	Development of HCV genotype 3a based replicon system
78.	Rasayani Biologicals Pvt. Ltd., Pune	--	Evaluation of Platinum Nano Particles for the Treatment of Hormone Refractory Prostate Cancer.
79.	Ravindranath G E Medical Associates Pvt.Ltd., Hyderabad	--	Functional evaluation of autologous cell based therapy in cardiovascular diseases - Molecular Imaging [An innovative non-invasive technology]
80.	Revelations biotech Pvt. Ltd., Hyderabad	--	Development of Novel and Economic process for production of recombinant human Insulin
81.	Revelations Biotech Pvt. Ltd., Hyderabad	IMTECH, Chandigarh	Development of low cost rapid quantitative PCR technology for molecular diagnostics
82.	Richcore Lifesciences Pvt Ltd., Bangalore	--	Enhancement of Ethanol Yield from Molasses Fermentation by adding a specific enzyme to convert an unfermentable sugar to a fermentable sugar
83.	Rossari, Mumbai	--	"Viable Enzymes production using Agro waste/Produce as Raw material of Industrial/Feed and Health care use with large viable Market/Demand"
84.	Saveer Biotech, New Delhi	--	Commercial Scale Production of Nanopesticides and Nanofungicides for Indian Agro-industry
85.	Sea6 Energy Pvt. Ltd., Chennai	--	Cost-effective offshore biomass production and bio-conversion to fuel
86.	Serum Institute of India Ltd. Pune	--	Clinical development of Polysialylated Erythropoietin
87.	Serum Institute of India Ltd., Pune	--	Development of HPV vaccine

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
88.	Serum Institute of India Ltd., Pune	National Institute of Immunology, New Delhi	Design and evaluation of novel immunogens & monoclonal antibodies against pandemic H1N1
89.	Span Diagnostics Ltd., Surat	–	Establishment of bioprocess facility for large scale production of Microbial antigens and monoclonal antibodies under the conditions compliant with cGMP
90.	SPC Biotech Private Ltd., Hyderabad	–	Bioconversion of agricultural waste from mango kernel to polylactic acid a Bioplastic
91.	Sphaera Pharma Research and Development Pvt. Ltd., Manesar	–	Novel combination therapy for treatment of resistant and nonresponsive cancers
92.	Sri Biotech Laboratories India Ltd. Hyderabad	ICRISAT, Hyderabad	Development of Actinomycetes based metabolites as delivery systems for soil health management in Groundnut (Arachis hypogaea L.)
93.	Sri Biotech Laboratories India Ltd., Hyderabad	University of Delhi, South Campus	Control of Shoot and Fruit Borer Insect Pest in Brinjal through RNA interference
94.	Stempeutics Research Pvt. Ltd., Bangalore	–	A Randomized, Double Blind, Multicentric, Placebo Controlled, Phase II Study Assessing The Safety And Efficacy of Intraarterial (Hepatic) Ex-Vivo Cultured Adult Allogenic Mesenchymal Stem Cells in Patients with Liver Cirrhosis.
95.	Strand Life Sciences Pvt. Ltd., Bangalore	–	Hepatotoxicity Prediction Platform
96.	Sun Pharmaceuticals Industries Ltd., Vadodara	–	Bevacizumab upto Pre-clinical studies
97.	Tata Chemicals Innovation Centre, Pune	–	Inorganic and polymer nanocomposites for micronutrient and pesticide delivery: boosting crop health and yield
98.	TCG LifeSciences Ltd, Kolkata	–	Process for Asymmetric Synthesis of Hexahydrobenzophenanthrenes, Dopamine D1 Agonists
99.	Tergene Biotech Private Limited, Hyderabad	–	Development of an Affordable, Asia specific 15 valent Pneumococcal Polysaccharide-CRM 197 Protein Conjugate Vaccine.
100.	Tergene Biotech Pvt. Ltd., Hyderabad	–	Development of an Affordable, Asia Specific 15 valent Pneumococcal Polysaccharide-CRM 197 Protein conjugate vaccine
101.	Thermax, Pune	–	Development of Anaerobic Membrane Memberane Bioreactor (An MBR) for Waste to Energy Solutions
102.	Torrent Pharmaceuticals Limited, Ahmedabad	–	A Strategy for the Development of Alternative Treatments for Heart failure Complicated with Diabetes Mellitus
103.	Torrent Pharmaceuticals Limited, Ahmedabad	–	Clinical development of TRC150094, a novel Diiodothyronine (T2) analogue, for the treatment of cradiovascular (CV) risk factors defined by Metabolic syndrome (MS)".
104.	Transasia Bio-Medicals Ltd., Mumbai	–	To develop a novel immunoassay format for automated immunoassay analyzers using flash type chemilumin-escence and magnetic beads as matrix

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
105.	V Life Sciences Technologies Pvt. Ltd., Pune	--	Clinical investigation of Galnobax for the treatment of diabetic foot ulcers
106.	Vinvish Technologies Pvt. Ltd., Trivandrum	--	Design and Development of Photo Dynamic Therapy Laser System
107.	Virchow Biotech Pvt Ltd, Hyderabad	--	Development Of A Novel Mucosal Vaccine for Hpv
108.	Vivo Biotech,Hyderbad	--	Optimization of Scale-up/Purification and clinical grade material generation of recombinant Urate Oxidase
109.	Wockhardt, Aurangabad	--	Development of animal component free biosimilar recombinant protein therapeutics using mammalian platform technology

# List of Companies Funded under BIRAC Funding Schemes

ANNEXURE

## Small Business Innovation Research Initiative (SBIRI)

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
1.	ABC Genomics (India) Pvt. Ltd., Lucknow in collaborator with King George Medical University, Lucknow	–	A Point-of-Care (POC) Genetic Testing Device for TB Markers Suitable for Primary Health Care Centers (Phase-I)
2.	Abexome Biosciences Pvt Ltd., Bangalore	–	Towards generation of a library of monoclonal antibodies against human embryonic stem cells (Phase-I)
3.	ABL Biotechnologies Limited, Chennai (closed by DBT)	–	Process research for commercial production of docosahexaenoic acid (DHA) from Schizochytrium by submerged fermentation (Phase-II)
4.	ABL Biotechnologies Ltd., Chennai (PENDING)	–	Sustained-release drug delivery systems with liposomes and micropheres (Phase-I)
5.	Actis Biologics Private Limited, Mumbai	–	Sustained delivery of MSP36 (Phase-II)
6.	Aditya Biotech Lab and Research Pvt. Ltd, Raipur	–	Marker assisted introgression of yellow vein mosaic virus (YVMV) resistance trait in high yielding varieties of okra. (Phase-I)
7.	Aditya Biotech Lab and Research Pvt. Ltd., Raipur	–	Identification of DNA markers linked to elite traits in micro-propagated banana plants (Phase I)
8.	Adler Mediequip Pvt. Ltd., Pune	–	Design and development of an innovative locked bone plating system (Phase I)
9.	Advanced Neurosciences Allies Pvt. Ltd., Bangalore	Vittal Mallya Scientific Research Foundation, Bangalore Collaborator of Advanced Neurosciences Allies Pvt. Ltd., Bangalore	Pre-clinical studies of Human mesenchymal stem cells (MSCs) isolated and characterized from different sources in autoimmune disease, namely rheumatoid arthritis (RA) and type 1 diabetes (T1DM) (Phase -I)
10.	Amar Immunodiagnostics Pvt Ltd., Hyderabad	–	Development of diagnostic tools for GMO testing and agriculture disease diagnostics (Phase I)
11.	Anthem Biosciences Pvt. Ltd., Bangalore	–	Generation of an E. coli K 12 strain for extracellular production of industrial enzymes (Phase-I)
12.	ARA HealthCare Pvt. Ltd., Gurgaon	–	Product development, regulatory toxicology and pharmacology and Phase 1 human clinical trial of three recombinant therapeutic proteins (Phase-I & II)
13.	Arbro Pharmaceuticals Ltd., New Delhi	LSR Institute of TB and Respiratory Diseases, New Delhi AIIMS, New Delhi	Development and clinical validation of methods for diagnosis of tuberculosis and bacterial drug resistance by smear microscopy, culture and polymerase chain reaction using processed clinical samples and kit thereof (Phase - I)
14.	Aristogene Biosciences Pvt Ltd., Bangalore	Bangalore University, Bangalore	Development of improved PCR kits with internal control for shrimp viruses WSSV, YHV, TSV and IHHNV (Phase - I)

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
15.	Arjuna Natural Extracts Ltd., Aluva	—	Detailed chemical profiling and pre-clinical evaluation of a us-patented antidiabetic plant extract (Phase-I&II)
16.	Aumgene Biosciences Pvt. Ltd., Surat	—	Cloning and Expression of Recombinant Lipase enzyme (Phase-I)
17.	Auroprobe Laboratories, New Delhi	Maharshi Dayanand Gosamwardhan, Kendra, Ghaziabad	Detection of A1 and A2 ? casein variants in cows and development of high throughput genotype screening technology (Phase I)
18.	Avesthagen Limited, Bangalore	--	Scale-up and evaluation of high-value biosimilar product (Etanercept) aimed at providing cost-effective healthcare solutions to the emerging markets (Phase - II)
19.	Avesthagen Ltd., Bangalore	—	Hepatocyte-like cells generated from human embryonic stem cells (hESC) for hepatotoxicity screening of xenobiotics in the drug discovery process (Phase-I)
20.	Bangalore Biotech Labs Pvt. Ltd., Bangalore	—	Development of platform technology for adherent cells on microcarriers (Phase I)
21.	Bejo Sheetal Seeds Private Limited, Jalna	—	Genetically modified vegetable crops for insect pest and disease resistance (Phase - I)"
22.	Bejo Sheetal Seeds Pvt. Ltd., Jalna	Indian Agricultural Research Institute, ND	Development of Dual Resistance in Tomato against virus infection & insect damage (Phase I)
23.	Bharat Biotech International Ltd., Hyderabad	—	Development and standardization of manufacturing and testing methodologies for human neonatal rotavirus vaccine candidate (Phase-II)
24.	Bharat Serum and Vacines, Mumbai	—	"Expression of recombinant proteins for development for synthetic pulmonary surfactant for respiratory distress syndrome (Phase-I)"
25.	Bharat Serums and Vaccines Limited, Mumbai (ON)	—	Clinical development process development and scale-up of a commercially viable manufacturing process of recombinant Follicle Stimulating Hormone (FSH) expressed in recombinant Chinese Hamster Ovary (CHO) cell-line (Phase-II)
26.	Bharavi Laboratories Pvt. Ltd. Bangalore	—	Processes for manufacture of (S)-3-hydroxybutyrolactone from (S)-4-hydroxy-2-pyrrolidinone therefrom (Phase-I)"
27.	Bhat Biotech India Pvt. Ltd. Bangalore	National Institute of Malaria Research, ND	HRP-II/p-LDH based diagnostic kits for the differential detection of malarial parasites (Phase-I)
28.	Bhat Biotech India Pvt. Ltd. Bangalore	Manipal University, Manipal	Development of probes based on a human BAC library for the diagnosis of disease for use in situ hybridization and in microarray" (Phase-I)
29.	Bigtec Private Ltd., Bangalore	—	Development of MEMS based sensor for neutrophil gelatinase-associated lipocalin (NGAL) for diagnosis of acute kidney injury (AKI) (Phase - I)
30.	Bionary Bioproducts Pvt. Ltd. Hyderabad	—	Development of L-arginine production process with novel genetically engineered E.coli strains" (Phase-I)

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
31.	Bioorganics and Applied Materials Pvt Ltd., Bangalore	–	Deuterium labeling of molecules for drug discovery and clinical research (Phase-I)
32.	Bioseed Research India Ltd., Hyderabad	Shriram Bioseed Genetics India Ltd., Hyderabad International Centre for Genetic Engineering and Biotechnology, New Delhi	Development of drought tolerant genotypes of rice, corn and cotton through genetic engineering (Phase - I)
33.	Bioseed Research India Pvt. Ltd., Hyderabad	Shriram Bioseed Genetics India Ltd., Hyderabad International Centre for Genetics Engineering and Biotechnology Biotechnology, New Delhi	Development of transgenic salinity tolerant rice hybrids (Phase - II)
34.	Bisen Biotech & Biopharma Pvt. Ltd., Gwalior	Jiwaji University, Gwalior	TB screen test for diagnosis of pulmonary and extra-pulmonary tuberculosis: evaluation of prototype kit at selected hospitals/ peripheral health centres/ research laboratories (Phase-I)
35.	Cadila Pharmaceuticals Ltd., Ahmedabad	–	Development of Mycobacterium was an adjuvant for anti-rabies vaccine (Phase -I)
36.	Century Pharmaceuticals Ltd., Vadodara	–	Apoptosis - inducing human - origin Fce - based chimeric proteins for targeted elimination of mast cells and basophils: a new approach for allergy and asthma treatment (Phase-I)
37.	Codon Biosciences Pvt. Ltd., Goa	–	Development of cost-effective process for the production of bi-functional cellulase with endoglucanase and $\beta$ -glucosidase activities from Streptomyces species (Phase I)
38.	Codon Biotech Pvt Limited, Noida	–	Studies on bioconversion of glycerol, a by product of Biodiesel industry, into economically important 1,3 propandiol, its purification and scaling up (Phase-I)
39.	Curadev Pharma Private Limited, Noida	–	Restoring The Body's Intrinsic Tumor Eradication Ability Through The Discovery Of Novel Small Molecule Modulators of The Apoptotic Pathway (Phase - I)
40.	Customised Technologies Pvt. Ltd., Bangalore	–	"Development of automated bioinstruments viz. automated dispensing system and automated cell counter (Phase-II)
41.	Devleela Biotech, Raipur	–	Collection and Characterization of Chironji (Buchanania lanzan) from Chhattisgarh & Orissa forest and development of tissue culture protocol for large scale multiplication. (Phase-I)
42.	Devleela Biotechs, Raipur	Indian Agricultural Research Institute, N Delhi	Production of virus free garlic through tissue culture (Phase I)
43.	Embio Limited, Mumbai	–	Demonstration of conversion of Benzaldehyde to Phenylacetylcarbinol (PAC) with improved efficiency on scale of 4 KL (Phase-II)
44.	Enzene Biosciences Pvt Ltd., Bangalore	–	Expression of Peptidyl Amidase and Aprotinin in Baculoviral Systems & Development of Silkworm as a Bioreactor (Phase I)

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
45	Erkadi Systems, Bangalore	—	Proposal for Low Cost Blower / BLDC Motor ICU Ventilator" (Phase-II)
46	Excel Matrix Biological Device Pvt. Ltd., Hyderabad	National Institute of Immunology, New Delhi	Novel tissue engineering and three dimensional cell culture technology (Phase-I)"
47.	Frontier Lifeline Pvt Ltd, Chennai	—	Tissue engineering of homologous natural biomaterial for clinical use (Phase-I)
48.	Ganga Kaveri Seeds Pvt Ltd., Hyderabad	—	Development of Bacterial leaf Blight resistant Rice Hybrids through molecular marker assisted breeding. (Phase I)
49.	Ganga Kaveri Seeds Pvt. Ltd., Hyderabad	—	Development of blast resistant rice hybrid (GK 5017) and rice variety (GK46) through Molecular Marker Assisted Breeding. (Phase I)
50.	Genomix Molecular Diagnostics Pvt. Ltd., Hyderabad Hyderabad	Birla Institute of Technology & Science, Pilani National Institute of Malaria Research, New Delhi National Institute of Malaria Research Field Station, Jabalpur Osmania University, Hyderabad	Developing sensitive, inexpensive and hand-held diagnostic point of care (POC) instrumentation to detect malaria and other pathogens (Phase I)
51.	Global Transgenes Limited, Aurangabad	—	Generation, evaluation and regulatory appraisal of selected transgenic events for enhanced tolerance against lepidopteran insect pests in cotton, rice and brinjal. (Phase I and Phase II)
52.	GVS Biotech Pvt. Ltd., Banga, Punjab	—	Commercial scale extraction unit to produce 0-calorie natural sweetener from stevia leaves (Phase II)
53.	Healthline Pvt. Ltd., Bangalore	—	Silk protein blend film for wound management - Standardization of production process, clinical evaluations, value enhancement and concept establishment (Phase-II)
54.	Healthline Private Limited, Bangalore	—	Developing face mask for cosmaceutical application using sericin and other natural bioactive agent on non-woven silk sheet (Phase-I)
55.	Healthline Pvt. Limited, Bangalore	—	Silk protein blend film development and commercialization for burn wound management (Phase-I)
56.	Hi Tech BioSciences India Ltd., Pune	Indian Institute of Technology, Mumbai	Development of platform technology for nitrilase catalyzed biotransformation processes (Phase I)
57.	Hi Tech Bio Sciences India Ltd., Pune	National Chemical Laboratory, Pune	Development and Scale-up of novel biopesticides based on M. anisopliae for control of Helicoverpa armigera (Phase I)
58.	Hydrolina Biotech Private Limited, Chennai	—	PROVE IT : Promoting Rural Opportunities by value additions through extraction intervention technologies to Agri/Horti Crops- Lycopene from tomato (Phase-II)
59.	I Cube Nanotec India Pvt. Limited, Noida	Institute of Microbial Technology (IMTECH), Chandigarh	Conversion of lactose and glucose based feedstocks to Butanol -feasibility study (Phase-I)

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
60.	IcubedG Ideas Private Limited, New Delhi	–	Risk based Process Design for large scale Manufacturing of male injectable contraceptive (Phase-I)
61.	Imgenex India Pvt. Ltd., Bhubaneswar	Institute of Life Sciences, Bhubaneswar	Nanotechnology based delivery of peptide inhibitors for the treatment of Osteoporosis (Phase-I)
62.	Imgenex India Pvt. Ltd., Bhubaneswar	–	Generation of induced pluripotent stem (iPS) cells from adult somatic cells using non-genomic protein transduction method (Phase-I)
63.	Incozen Therapeutics Pvt. Ltd., Hyderabad	–	Discovery and Development of Novel, Selective and Potent Dihydroorotate Dehydrogenase Inhibitors in Inflammatory Bowel diseases (Phase I)
64.	India Pesticides Ltd., Lucknow	–	Large scale production of curcumin-piperoyl conjugate (Phase-I)
65.	Indian Immunologicals Limited, Hyderabad	Indian Institute of Sciences, Bangalore	Generation of prototype lateral flow assay kit using antigen specific hybridomas to develop rapid diagnostic test for clinical diagnosis of malaria (Phase I)"
66.	Indo American Hybrid Seeds (India) Pvt. Ltd., Bangalore	–	Utilization of marker assisted selection for development of salt tolerant hybrids in rice (Oryza sativa) (Phase-I)
67.	Indovax Pvt. Ltd., Gurgaon	–	Development of cell associated serotype 1 Marek's Disease vaccine of Poultry from an indigenous field isolate (Phase I)
68.	Invictus Oncology Pvt. Ltd., New Delhi	–	Development of Antibody-Platinum Conjugates for the Therapy of EGFR-overexpressing Tumors (Phase I)
69.	iTrace Nanotech (P) Limited, Secunderabad in collaboration with Indian Institute of Chemical Technology, Hyderabad	–	Advanced active transdermal drug delivery for migraine management. (Phase-I)
70.	Jay BioZyme Technologies, Pune	University of Delhi South Campus, New Delhi	Process development and application of pectinase for retting of plant fibers (Phase-I)
71	JC Biotech Private Ltd., Hyderabad	–	Scale up and optimization of the process for production of Pneumocandin B0 by aerobic fermentation of Glarea lozoyensis (Phase-II)
72.	Juan Biotechnology Private Limited, Bhubaneswar	–	Evaluation of potential antagonistic microorganisms for the management of sheath blight of rice (Phase-I)
73.	Jupiter Bioscience Limited, Secunderabad-	Maharaja Sayajirao University of Baroda, Baroda	Development, optimization and characterization of ligand (RGD peptides) targeted nano constructs encapsulating anticancer chemotherapeutic agents for effective treatment of lung cancer (Gemcitabine) and stabilization of lyophilized or spray dried formulation for direct local delivery or by injection through systemic circulation (Phase II)
74	KN Biosciences (India) Pvt. Ltd., Hyderabad	–	Fermentation technology for entomopathogenic nematode (EPN) production, (Phase-I)
75	Krishidhan Research Foundation Pvt. Ltd., Jalna	Jawaharlal Nehru University, New Delhi	Development of transgenic bhendi resistant to yellow vein mosaic virus (Phase-I)

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
76.	La Chandra Bioscience Private Ltd	—	Development of commercially viable micropropagation protocols in potato (Phase-I)
77.	Labland Biotech Pvt. Ltd., Mysore	—	Micropropagation of <i>Jatropha curcas</i> L. for sustainable and enhanced production of biodiesel (Phase-II)
78.	Lablinks Biotech Pvt. Ltd., Bangalore	—	Development of methods for large scale growth, characterization and applications of suspension and anchorage dependent cell cultures in the torocell disposable bioreactor systems (Phase I)
79.	Laila Impex, Vijayawada	—	Development of curcumin as high value phyto-pharmaceutical for treating cataract (Phase - II)
80	Laila Impex, Vijayawada in collaboration with Institute of Scientific Research on Vedas, Hyderabad, Indian Institute of Chemical Technology, Hyderabad	—	An Integrated Approach to develop herbal formulation - Patoladi Kashayam for treating microbial infections (Phase-I)
81.	LeadInvent Technologies Pvt. Ltd., New Delhi	All India Institute of Medical Science, New Delhi	Computational design & development of inhibitors for the treatment of tuberculosis (Phase I)
82	LeadInvent Technologies Pvt. Ltd., New Delhi	Indian Institute of Technology, Madras, Chennai	Study, design and development of Hit Molecules for cancer targets (Phase I)
83.	Lifecare Innovation Pvt. Ltd., Gurgaon	—	Development of affordable, toxicity free Amphotericin B loaded liposomal preparation for treatment of Kala-azar: A Pre-Proof of Concept (Phase - I)
84.	Maharashtra Hybrid Seeds Co. Ltd., Jalna	Indian Institute of Science, Bangalore	Evaluation of transgenic cotton containing antisense AV2 gene for resistance to cotton leaf curl disease (Phase - I)
85.	Maps (India) Limited, Ahmedabad (closed)	—	Up-scaling and downstream processing of industrially important enzymes from solid state fermentation to submerged fermentation for import substitution with export potential (Phase-II)
86.	Maps Enzymes Limited, Ahmedabad	—	Development of a cost effective process for phytase production and its application studies (Phase-I)"
87.	Mediclone Biotech Pvt. Ltd, Chennai	—	Development of an alternate technology to Anti Snake Venom Serum (ASVS) using monoclonal F(ab)2 cocktail (Phase - I)"
88.	Mediclone Biotech Pvt. Ltd., Chennai	—	Commercial production of monoclonal antibodies, as an import substitute, with special reference to red blood cell phenotyping (Phase-II)
89.	MediVed Innovations Pvt. Ltd., Bangalore	—	Design, development and clinical evaluation of implantable drug eluting cardiac pacing leads (Phase II)
90.	Microbax (India) Ltd., Hyderabad in collaboration with Talwar Research Foundation (TRF), New Delhi	—	Development, industrial manufacture and marketing of selected probiotic tablets containing <i>Lactobacillus</i> strain(s) along with polyherbal microbicide for relieving vaginosis/ vaginitis and replenishment of probiotic <i>Lactobacilli</i> strains (Phase II)

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
91.	Millennium Exports, Chennai	Aquaculture Foundation of India, Chennai	Pet animal food, fish leather and other marine biotechnology products from fish waste (Phase I)
92.	Multiplex Biot-Tech Pvt. Ltd., Bangalore	–	Enhancing the effectiveness of nucleopolyhedro-viruses of <i>Helicoverpa armigera</i> (HaNPV) and <i>Spodoptera litura</i> (SINPV) through incorporation of enhancing inclusion proteins and sun-light UV protectants in commercially produced HaNPV (Helimar) and SINPV (Spodomar) (Phase-I)
93.	Myko Tech Pvt. Ltd., Goa	AsthaGiri Herbal Research Foundation, Chennai	Synthesis of novel molecular drugs through biopolymerization of active principles from medicinal plants using the laccase enzyme (Phase-I)
94.	Nandan Biomatrix Limited, Hyderabad	–	Micropropagation of Nandan-1 and Nandan-2, high yielding <i>Jatropha curcas</i> (L) hybrids for sustainable & profitable cultivation (Phase I)
95.	Navya Biologicals Pvt Ltd., Dharwad	–	Optimization of fermentation and purification of recombinant human serum albumin (HSA) and recombinant human thrombin produced in yeast. (Phase II)
96.	Navya Biologicals Pvt. Ltd., Bangalore	–	Development of a platform for production of complex peptides and proteins (Phase-I)"
97.	Nuziveedu Seeds Ltd., Hyderabad	International Centre for Genetic Engineering and Biotechnology (ICGEB), New Delhi	Stacking of candidate genes (validated in planta) addressing different moisture stress resistance strategies in maize ( <i>Zea mays</i> ) (Phase I & II)
98.	Nuziveedu Seeds Pvt. Ltd., Secunderabad	–	Biofortification of maize with $\beta$ -carotene and high quality protein using functional genomics and molecular breeding approaches (Phase-I)
99.	Ocimum Biosolutions Ltd., Hyderabad	International Centre for Genetic Engineering and Biotechnology, New Delhi	Development and validation of miRNA expression platform for plants, modeled in rice (Phase I)
100.	Orbit Biotech Pvt. Ltd., Mohali	–	Development of Reuterin based biopreservative as an alternative to harmful sodium nitrite & sodium nitrate based chemical preservatives; for use in packaged meat food products (Phase I)
101.	Orchid Chemicals & Pharmaceuticals Ltd.	–	Discovery & Development of novel HDAC inhibitors as anti-malarial agents (Phase-I)
102.	Orchid Research Laboratories Limited, Chennai	AU-KBC Research Center, Chennai	Development and validation of a cell-tissue co-culture model for aiding liver specific studies and drug discovery applications (Phase I)
103.	Oriental Aquamarine Biotech India Pvt. Ltd., Coimbatore	Cochin University of Science and Technology, Kochi	Design modification and commercialization of nitrifying bio-reactor technology for the establishment of organic recirculation prawn seed production system (Phase-II)
104.	Oriental Aquamarine Biotech India Pvt. Ltd., Coimbatore	Cochin University of Science and Technology, Kochi	Detailed performance evaluation and accelerated commercialization of the nitrifying bioreactor technology in Indian Market" market" (Phase-II)

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
105.	Oxygen Healthcare Research Pvt. Ltd., Ahmedabad	—	Design, synthesis, evaluation and development of the Novel H3 and other GPC receptor ligands for various therapeutic applications (Phase-I)
106.	Panacea Medical Technologies Pvt Ltd, Bangalore	—	Radiation field analyzer (RFA) (Phase-I)
107.	Pelican Biotech & Chemical Labs (P) Ltd, Alappuzha, Kerala	—	Value added products from crustacean exoskeleton and coir pith-integrated zero discharge processing project (Phase-II)
108.	Pelican Biotech and Chemical Labs Pvt. Ltd, Kochi in collaboration with Tropical Botanic Garden & Research Institute, Palode and Women's Emancipation and Development Trust (WED Trust), Madurai	—	Process Development for the Manufacture of High Quality Retted Coir Fibre by Eco Friendly Technology through Solid State Fermentation and Production of Edible Mushroom as Byproduct (Phase-I)
109.	Pelican Biotech and Chemical Labs, Alapuzha Kerala	—	Novel methods of isolation of biochemicals from crustacean exoskeleton (Phase-I)
110.	Perfint Healthcare Private Limited, Chennai	—	Design and development of a Smart Sensor System for therapy monitoring and validation of soft tissues tumors (Phase I & II)
111.	Perfint Healthcare Pvt. Ltd., Chennai	—	Commercialization of PIGA- A platform of medical tool positioners for use in Image Guided Interventional Procedures (Phase II)
112.	Phyto Biotech Pvt. Ltd., Bangalore	—	Artificial cultivation of a rare himalayan fungus Cordyceps for its medicinal use (Phase-I)
113.	PhytoMyco Research Pvt. Ltd., Nanjangud	—	Scientific validation and standardization of the active fraction, PM2040, enriched from the patient tested ayurvedic anti-diabetic drug, Parinam (Phase-I)
114.	Pochiraju Industries Limited, Ranga Reddy District, A. P.	—	Production and evaluation of a novel hexavalent lipo-oligosaccharide vaccine for Neisseria meningitidis against meningococcal disease (Phase I)
115.	Poseidon Biotech, Chennai	—	Control of White Spot Syndrome Virus (WSSV) of shrimp in the culture system by Nanoparticles/modified nanosystem (Phase-I)"
116.	Privi Organics Ltd., Navi Mumbai	—	Enzyme catalyzed manufacture of esters (Phase-I)
117.	Proalgen Biotech Ltd., Chennai	—	Pilot scale production of biodiesel from algae (Phase II)
118.	Rasi Seeds (P) Ltd., Attur	Tamil Nadu Agricultural University, Coimbatore	Transgenic cassava production with genes conferring resistance to Indian cassava mosaic virus disease (Phase I)
119.	Ravindranath GE Medical Associates Pvt. Ltd., Hyderabad, (Global Hospitals Pvt Ltd) in collaboration with University of Hyderabad, Hyderabad	—	Development of multiplex PCR and Real Time PCR assay systems for the identification of methicillin resistant Staphylococcus aureus (MRSA) (Phase-I)
120.	Reliance Life Sciences Pvt. Ltd., Navi Mumbai	—	An open label, multicenter, prospective clinical study to evaluate the safety and efficacy of tissue engineered R-STE-001 in patients with symptomatic cartilage defect of femoral condyle (Phase-II)

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
121.	Reliance Life Sciences Pvt. Ltd., Navi Mumbai	–	Micropropagation of date palm for sustainable agriculture and rural economic growth (Phase -I)
122.	Relisys Medical Devices Limited, Hyderabad	–	Manufacture and Clinical Evaluation of Non-Polymeric (Nano-carbon porous matrix) drug eluting stent (DES) (Phase - II)
123.	Remidio Innovative Solutions Pvt. Ltd., Bangalore	–	Design and Development of Field-testable prototypes of a Large Field of View, Battery Operated, Easy-to-Use Retinal Imaging Device for the diagnosis of Retinopathy of Prematurity (ROP) in premature infants. (Phase-I)
124.	Robonik India Pvt. Ltd., Mumbai	–	Design and development of automated in vitro diagnostic instrumentation (ELISA processor, automatic biochemistry and urine strip analysers). (Phase-II)
125.	Rope Production Centre, Madurai in collaboration with Krishi Vigyan Kendra, Madurai (Tamil Nadu Agricultural University, Coimbatore	–	Value addition and waste utilization in Banana pseudostem (Phase-I)
126.	Samleen Bioengineering Private Limited	–	Culture and characterization of Porphyromonas gingivalis under strict anaerobic conditions and characterization of gingipains (Phase -I)
127.	Sandor Proteomics Pvt. Ltd., Hyderabad	–	Cellular biomarkers of rejection and immuno-suppression in transplantation (Phase I)
128.	Sanzyme Limited (Formerly Uni-Sankyo Limited), Hyderabad	Institute of Chemical Technology (ICT), Mumbai	Extraction, purification, stabilization & biological studies of natural gonadotropins from urine (Phase-I)
129.	Scigenics Biotech Private Limited, Chennai	–	Research, design, engineer and manufacture Multi Deck Shaker (Phase -II)
130.	Shantani Proteome Analytics Pvt. Ltd., Pune	–	Development of a novel method to identify new drug targets for type 2 diabetes treatment (Phase - I)
131.	Shantani Proteome Analytics Pvt. Ltd., Pune	–	Validation of Small-molecule Target Identification Technology for its Versatility. (Phase-I)
132.	Simplyfeye Softwares Pvt. Ltd., New Delhi	–	Development of streaming data web-service engine for bioprocess equipments for improved monitoring of bioprocesses (Phase-I)
133.	Span Diagnostics Ltd., Surat	–	Manufacturing and commercialization of a low cost and reliable clinical chemistry analyzer (Phase II)
134.	Sri Biotech Laboratories India Ltd., Hyderabad in collaboration with University of Hyderabad	–	Scaling up production and data package development for commercialization of bioherbicides for weed management in rice. (Phase-II)
135.	Sri Biotech Laboratories India Pvt. Ltd., Hyderabad	University of Hyderabad, Hyderabad	Production, formulation and commercialization of microbial agents for weed management in rice (Oryza sativa L.) (Phase - I)
136.	Sri Raghavendra Biotechnologies Pvt. Ltd., Bangalore	–	Complete in-vitro characterization of umbilical cord Wharton's jelly - derived mesenchymal stem cells (UCMSC) (Phase - I)
137.	Sri Surya Anjaneya Industries, Visakhapatnam	–	Microbial process development for beta carotene production in Blakeslea trispora and up-scaling the down stream process (Phase-I)

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
138.	Stempeutics Research Pvt Ltd., Bangalore	—	Large scale expansion and characterization of human Wharton's Jelly-derived mesenchymal stem cells (Phase-I)
139.	Sugen Life Sciences Pvt. Ltd., Tirupati	—	Production of laboratory animal feed - special feed/ diet for experimental animals (Phase-II)
140.	Sugen Life Sciences Pvt.Ltd., Tirupati	—	Wound healing efficacy of novel formulation SLS-03: Pre-clinical studies (Phase I)
141.	Sun Agrigenetics Pvt. Ltd., Vadodara	—	Development of commercial scale micropropagation technology for elite Date palm (Phase I)
142.	Sun Agrigenetics Pvt. Ltd., Vadodara	—	Development of commercial scale micro propagation technology for elite Red Sandalwood in India (Phase-I)
143.	Surya Pharmaceuticals, Varanasi	—	Scientific validation of Bronco-T: A polyherbal formulation for bronchial asthma in experimental models (Phase - I)
144.	Symbiotec Pharma Lab Limited, Indore	—	Commercial scale up of biotransformation technology for steroids-hormones from soybean derived sterols (Phase-II)
145.	T. Stanes & Co. Ltd, Coimbatore	PSG of College of Technology, Coimbatore	Development of lipid lowering phytoformulations (Phase - I)
146.	T. Stanes & Company Ltd., Coimbatore	PSG College of Arts and science, coimbatore	Passive Immunotherapy using Chicken IgY Consortium with Probiotics supplementation for Gastrointestinal infections in Poultry (Phase - I)
147.	Thrombochek Labs Private Limited, Mumbai	—	To improve and standardize protocol of prognostic clinical laboratory testing for atherothrombosis by incorporating demonstration of thrombotic platelets using the new thrombochek test
148.	Total Potential Cell Pvt. Ltd.	—	Differentiation of Human Adipose tissue Derived Stem Cells to Islet Cell mass Aggregates and its preparation for clinical application (Phase - I)
149.	Tran-Scell Biologics Pvt. Ltd., Hyderabad	—	Stem cell implant biocomplexes for periodontal tissue regeneration (Phase-I)
150.	Transgene Biotek Ltd., Hyderabad	—	Novel process development and optimization of process parameters for orlistat production (Phase II)
151.	USV Ltd., Mumbai	—	Development of a Vaccine capable for eliciting immunological memory for the prevention of typhoid (Phase - II)"
152.	V. B. Medicare Pvt. Ltd., Hosur	—	Development and characterization of lipid carrier based nanogel formulation for 5-fluorouracil (Phase-I)
153.	Varuna Biocell Private Limited, Varanasi	—	Indigenous Production of Dextranase using SSF Technique" (Phase-II)
154.	Varuna Biocell Pvt. Ltd., Varanasi	—	Indigenous production of dextranase using SSF technique (Phase I)
155.	Vel Natural Fibers, Thoothukudi	—	Innovative method to extract silk grade banana fiber. (Phase-I)
156.	Vinvish Technologies Pvt. Ltd.	—	Design and development of fiber laser based portable Raman spectrometer (Phase - I)

S. No.	Name of the Company	Name of the Collaborator	Title of the Project
157.	Virchow Biotech (P) Limited, Hyderabad	–	Development of commercialization of a recombinant uricase for the prevention and treatment of tumor lysis syndrome associated with leukemia, lymphoma & solid tumor malignancies (Phase-II)
158.	Virchow Biotech Pvt. Ltd., Hyderabad	–	Indigenous Development of a Recombinant Fuzeon for the treatment of AIDS (Phase-II)
159.	Vivimed Labs Limited, Hyderabad	–	Process optimization for production of freeze-dried Brucella abortus Strain 19 Vaccine for veterinary use (Phase-I)
160.	Vivo Bio Tech Limited, Hyderabad	–	Production of recombinant exenatide (Incretin mimetic like GLP-1) (Phase II)
161.	Xcelris Labs Ltd., in collaboration with Abellon Agrisciences Ltd., and Abellon Clean Energy Ltd., Ahmedabad	–	Advanced active transdermal drug delivery for migraine management. (Phase-I)
162.	Yashraj Biotechnology Limited, Navi Mumbai	–	Development of highly specific immunoassays for prostate and breast cancer through molecular characterization of existing markers and establishment of novel markers (Phase-I & II)
163.	Zenotech Laboratories Ltd., Hyderabad	–	Development of humanized monoclonal antibodies against human epidermal growth factor receptor (Phase-I)

# List of Companies Funded under BIRAC Funding Schemes

## Biotechnology Ignition Grant (BIG)

S. No.	Title of the Proposal	Applicant Name	Applicant Type
1.	Development of an aptamer-based platform to detect novel Tuberculosis markers in human serum	Achira Labs Pvt Ltd	Company
2.	Enzymatic maceration of mango pulp to produce quality wine	Codon Biosciences	Company
3.	Pharmacological Evaluation of N-oxide Metabolite of Antipsychotic Drug for Type 2 Diabetes	Crystalin Research Pvt Ltd	Company
4.	Fetal Electrocardiogram and Uterine Activity signal extraction from Maternal Electrocardiogram eliminating the need for the use of conventional transducers	Dinesh B R	Individual
5.	Engineered stable, nano-sized bubble liposomes - a commercially viable drug delivery platform	Dr Praveer Gupta	Individual
6.	Development of Diagnostic Reagents for Acute Myocardial Infarction	G.M. Biotech	Individual
7.	Intraosseous Device	Intraosseous Device, Dr. Jayant Karve	Individual
8.	Biochemical Research & Development to Improve the Efficacy of a Dry, Thermophilic, Anaerobic Reactor	Mainak Chakraborty GPS System	Company
9.	Rapid Detection of Acute Myocardial Infarction by sensing Cardiac Markers using Micro Cantilever Technology	NanoSniff Technologies Pvt. Ltd.	Company
10.	Study, Design and Development of Hit Molecules for Type II Diabetes	Novo Informatics Pvt. Ltd.	Company
11.	Modular Resilin-mimetic Elastomeric Platform	Pandorum Technologies Pvt. Ltd.	Company
12.	A Platform for Rapid Antibiotic Susceptibility Testing (AST) and Assessment Of Bacterial Load	Sabio Innovative Solutions Pvt Ltd	Company
13.	Metabolic Engineering of marine bacteria for the production of isobutanol in salt water	Sea6 Energy	Company
14.	Novel Oncotherapeutic Measles Virus using eSAME system	Seagull BioSolutions Pvt. Ltd	Company

S. No.	Title of the Proposal	Applicant Name	Applicant Type
15.	Expression of therapeutic diabody against TNF-alpha and IL-17R.	Vikas Mehra	Individual
16.	Novel inhibitors of DNA Gyrase for the treatment of multidrug resistant infections	Vitas Pharma Research Private Limited	Company
17.	Cancer treatment through autologous activated dendritic cells	Western Range Biopharmaceuticals	Company
18.	Creation of transgenic zebrafish as cancer models	Zephase Therapeutics Pvt. Ltd.	Company

