



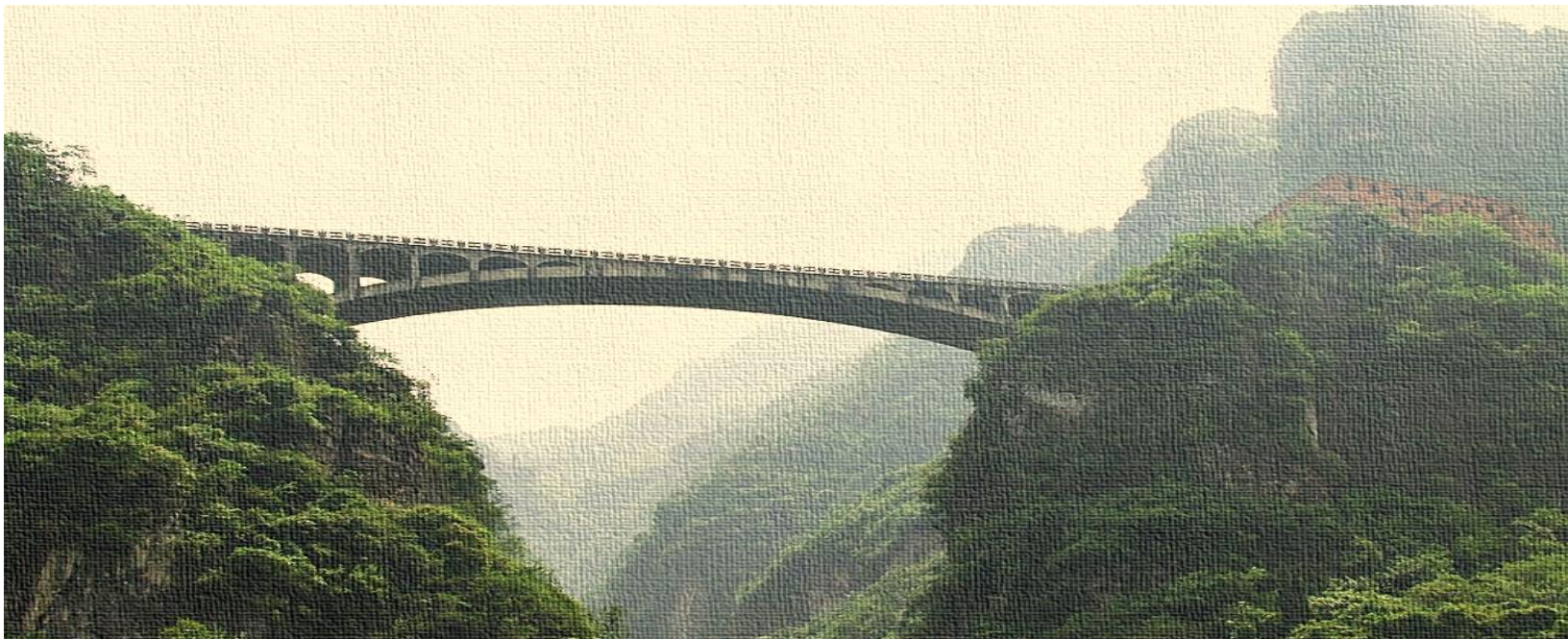
DR.REDDY'S  
INSTITUTE OF LIFE SCIENCES



# Dr. Reddy's Institute of Life Sciences

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Annual Report 2020-2021



## FROM THE DIRECTOR



Dr. Reddy's Institute of Life Sciences is a research institute with a passion for science and learning, and a purpose to catalyze innovative and sustainable research. Building bridges with industry is an important part of the Institute's mission. The impact of the Institute's work is evident in its steady progress and sustained focus on quality.

Our grants and publications are a valuable source of support for our research, and have been possible due to a genuine interest in science, a focus on asking new questions, and consistent performance by our team of scientists. The students we have trained bear testimony to our efforts, and we continue to be motivated by youngsters seeking opportunities in science and choosing to work with us.

The industry projects we undertake continue to be challenging and novel, with the common underlying theme of creating value for our industry partners and collaborators. We are constantly motivated by the goal of generating science-driven solutions for processes and products, and the resultant patents.

We recognize and value the continued support and guidance received from Dr. Reddy's Laboratories, the University of Hyderabad and the Govt. of Telangana, all of whom have been an integral part of our journey. We are grateful to all our well-wishers and look forward to cultivating valuable and long-lasting relationships with our future collaborators and partners.

The year 2020, which was marked by the global COVID pandemic, also presented opportunities for us to initiate projects relevant to the battle against the pandemic. I am happy to note that we responded well and continue to work on several relevant projects with our collaborators. As always, embarking on new opportunities and strengthening ongoing efforts continue to be the mantra at Dr. Reddy's Institute of Life Sciences.

**Srinivas Oruganti**

Director, DRILS, Hyderabad  
August 2021



INNOVATION ▲ RESEARCH ▲ SUSTAINABILITY

## ABOUT DRILS

Dr. Reddy's Institute of Life Sciences (DRILS) is a not for profit Research Institute with a mission to be the preferred research partner to the pharma and life sciences industry. DRILS focuses on original research and advancement of relevant skills, with emphasis on solution-oriented interdisciplinary research for solving unmet needs and for process innovation. The Institute has been set up on a public-private partnership model by Dr. Reddy's Laboratories, the Government of Telangana, and the University of Hyderabad, and is governed by a Board of Directors comprising eminent scientists and visionaries.



The vision of our Founder Chairman, Padmabhushan Dr. Kallam Anji Reddy, can be eloquently summarized in his own words.

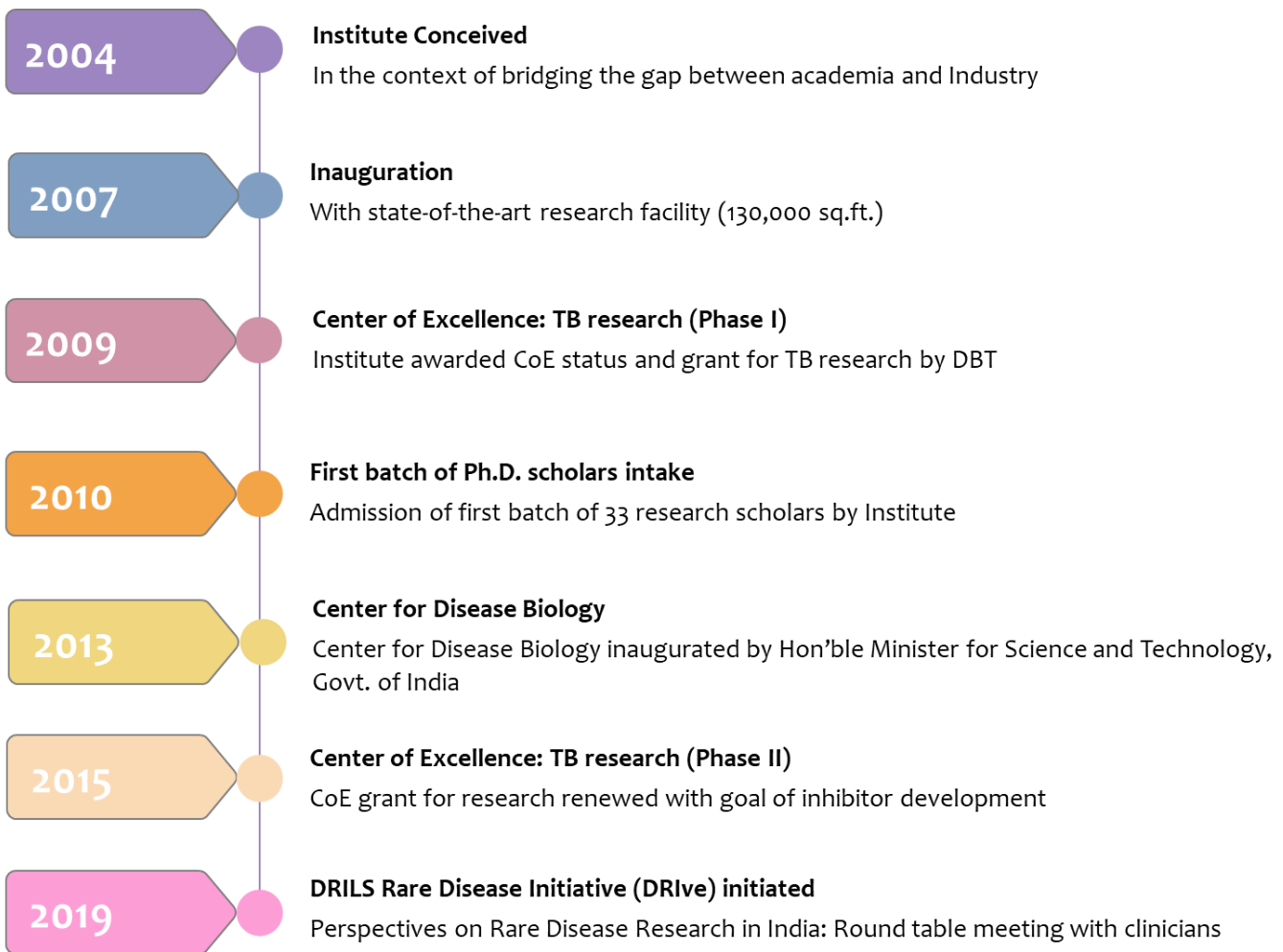
*"If the world's burden of disease is to be diminished, it needs science that is both good and cost-effective. India has the potential to deliver on science that is both. I have great confidence in our army of chemists and biologists. And I firmly believe that walking on the trail of innovation will lead to creating a great company - a company that doctors, patients, investor and the public will admire."*

DRILS as a research center became operational in 2007. Since then, it has provided a vibrant platform to several scientists from industry and academic backgrounds in their pursuit of advanced knowledge and relevant skills. Research at DRILS is supported by external funds such as government grants or industry-sponsored grants, or internal funds for selected areas. DRILS is organized into three centers, the Center for Innovation in Molecular and Pharmaceutical Sciences (CIMPS), the Center for Process Research Innovation (CPRI) and the Center for Advancement of Research Skills (CARS).

CIMPS represents the Institute's core research activity, and comprises scientists with diverse technical backgrounds spanning advanced molecular biology, cell biology, pharmacology, organic and medicinal chemistry and nanochemistry. CPRI is the Institute's chemistry vertical engaged in addressing the industry's chemical research and innovation needs, with the main thrust areas being process R&D and medicinal chemistry. CARS focuses on training programs to advance the skills and aptitude in basic science and industry-relevant areas, among students, teachers and industry recruits.

Scientists at DRILS are also actively engaged in mentoring Masters and Ph.D students and post-doctoral fellows supported by government fellowships and research grants.

## Historical Milestones



## Operations

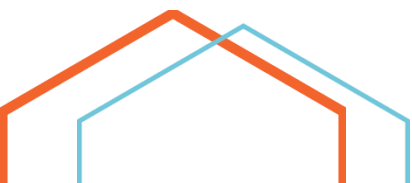
Corporate style governance coupled with an academic research culture.

First of its kind Institute in India, dedicated to excellence in collaborative translational research.



## Our Board of Directors

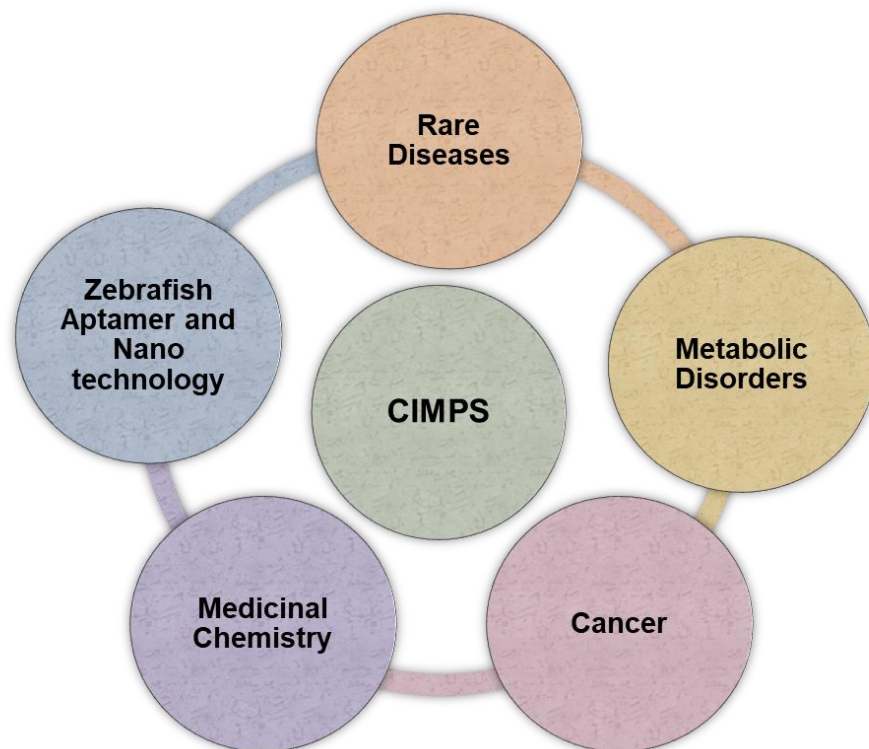
Name	Designation
Mr. G.V. Prasad, Chairman of the Board	Co-Chairman & Managing Director, Dr. Reddy's Laboratories Ltd.
Mr. Satish Reddy	Chairman, Dr. Reddy's Laboratories Ltd.
Ms.Mahima Datla	Managing Director, Biological E Ltd.
Prof. Basuthkar Jagadeeshwar Rao <i>Ex-officio</i>	Vice Chancellor, University of Hyderabad.
Shakthi Nagappan <i>Ex-officio</i>	Nominee of Principal Secretary, Dept. of Industries and Commerce, Govt. of Telangana.
Dr. Srinivas Oruganti	Director, DRILS
Dr. A. Venkateswarlu	Former Director, DRILS
Prof. D. Balasubramanian	Distinguished Scientist and Director Emeritus, Prof. Brien Holden Eye Research Centre, L.V. Prasad Eye Institute.
Prof. Seyed E. Hasnain	Vice-Chancellor, Jamia Hamdard and Former Vice Chancellor, University of Hyderabad.
Prof. Goverdhan Mehta	Dr. Kallam Anji Reddy Chair and Distinguished Professor, University of Hyderabad.



## Centers

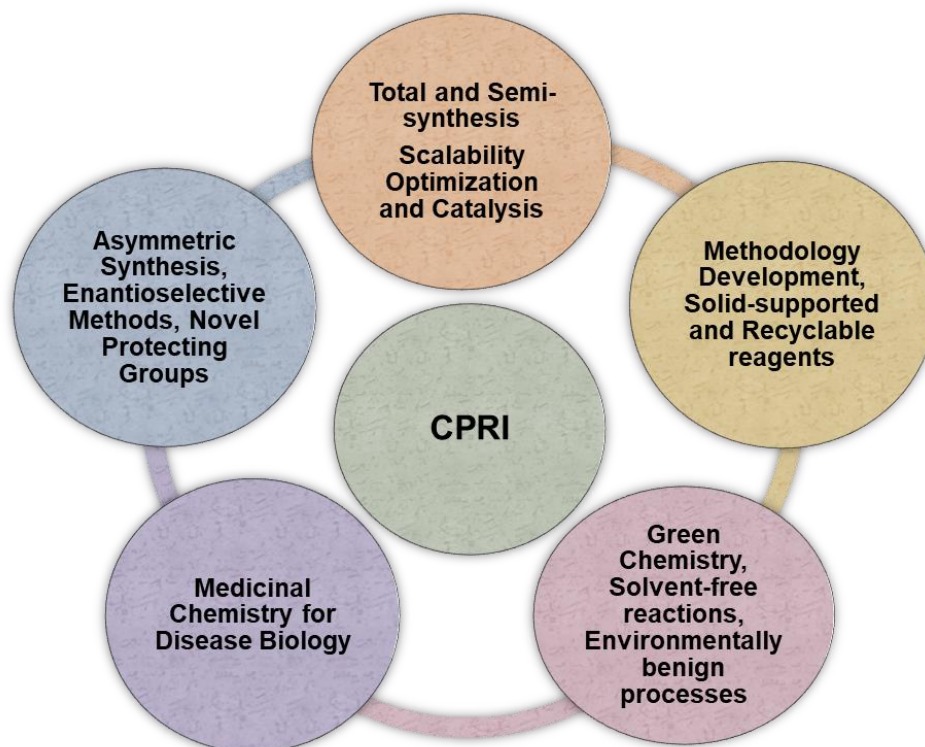
### Center for innovation in molecular and pharmaceutical sciences

The Center for Innovation in Molecular and Pharmaceutical Science (CIMPS) represents the institute's core research activity. Scientists at CIMPS have diverse technical backgrounds, spanning advanced molecular biology, cell biology, pharmacology, organic and medicinal chemistry, and nanochemistry. Research at CIMPS is supported by external funds such as government grants or industry-sponsored grants, or via internal funds for selected areas. Ph.D. Students and post-doctoral fellows with government fellowships work on government-funded research projects.



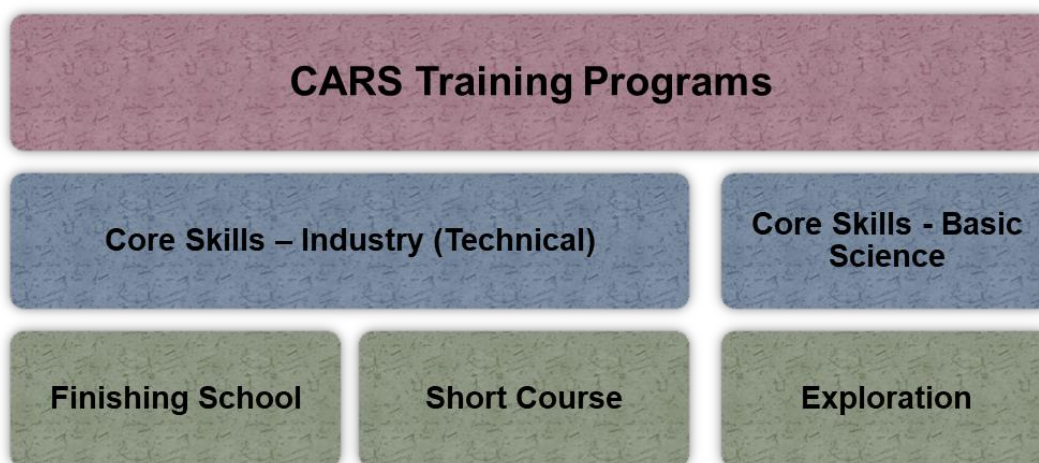
### Center for process research innovation

The Center for Process Research Innovation (CPRI) is engaged in addressing chemical research and innovation needs of the industry. CPRI has two main thrust areas: Process R&D and Medicinal Chemistry. Process research involves the identification and development of novel synthetic routes that targets sustainability through simplicity with potential for IP generation. Chemical industry needs are met not only by de novo approaches, but also through evolution of synthetic routes through a continuous process of incremental improvement and gradual simplification of the existing chemical processes.

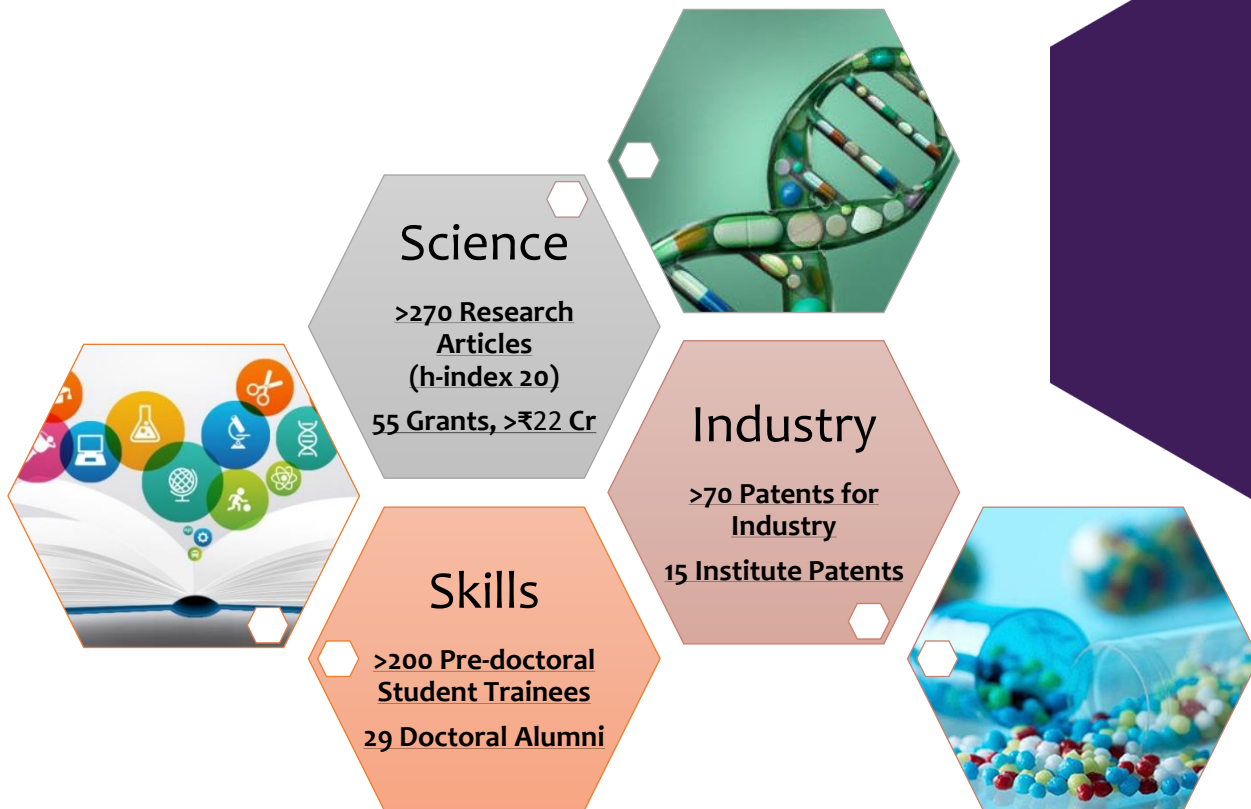


## Center for advancement of research skills

Creation of a research talent pool for the nation's emerging scientific and research needs has been a key area of activity at DRILS. The Center for Advancement of Research Skills (CARS) is engaged in addressing skill development and training needs in industry and academia. Structured into industry-relevant technical skills and academia-relevant basic science skills, CARS conducts training programs for students and industry professionals. In-house scientists and external experts provide the training depending on the requirements of the program.



## DOMAINS OUR WORK HAS IMPACTED



Our Work Over The Last 12+ Years Has Contributed To Fundamental Knowledge In Biology And Chemistry, Significant Value Creation For Industry, And Advancement Of Research Skills And Understanding Among Future Scientists.






- Uniquely positioned as an institute driven by a culture of science, and created to support the life sciences and pharma industries, our work is designed to bridge academia and industry.
- The institute has diverse networking and engagement with eminent researchers, start-ups, institutes, universities and reputed companies, and continues to attract the best and the brightest.
- We have contributed to innovation-focused product development across a range of industries including Pharmaceuticals, Nutraceuticals, Agrochemicals and Organic Materials.
- Integrating various disciplines in Chemistry and Biology, we have adopted best industry practices to support product development and innovation in the pharmaceutical industry.

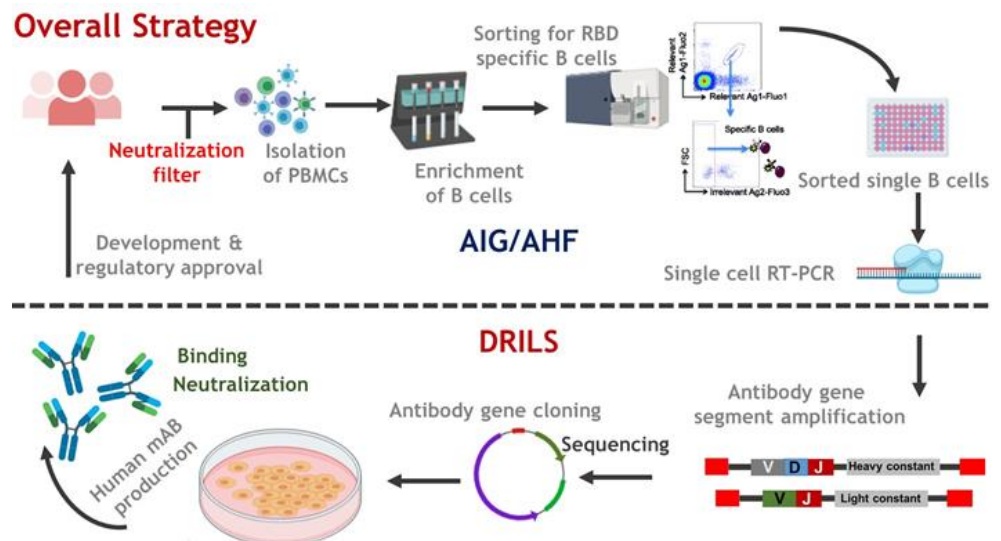
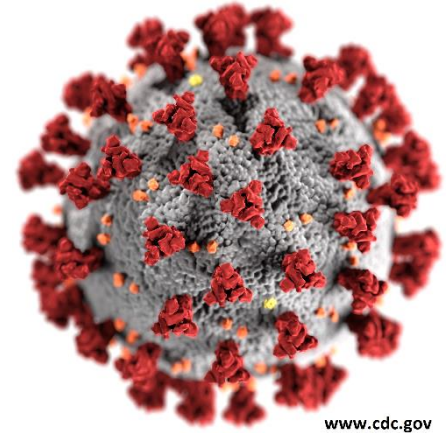


## MAJOR THEMATIC AREAS OF OUR WORK



## Contributions of DRILS towards combating COVID-19 pandemic

- 
**Assembling a special COVID-19 team during lock-down**
  - A small core team of 10 select scientists and chemists were identified to engage in streamlined research and development of complex pharmaceuticals needed for treatment of COVID-19 infection, and enable transfer of the research results to pharmaceutical collaborators for fast-tracking manufacture of anti-viral drugs that are critically needed for combatting the COVID-19 pandemic.
  - Within a span of just two months, the special COVID-19 team were successful in delineating the end-to-end synthesis of two anti-virals indicated for COVID-19 infection, starting from basic raw materials that could be sourced during the lock-down. The experimental results and reference standards generated were crucial for the manufacturing teams to fast-track initiation of KSM synthesis and development of analytical methods.
- 
**Collaboration with AIG hospitals to gain insights into the cellular entry of SARS-CoV-2 with potential implications to Indian population**
  - AIG identified a genetic polymorphism (common in Indian population) in a membrane protease required for viral entry. DRILS research provided experimental evidence linking the polymorphism to the activation of SARS-CoV-2 spike protein.
- 
**Ongoing collaboration with AIG to identify monoclonal antibodies against spike protein of SARS-CoV-2 from convalescent subjects**
  - Grant submitted to DHR; preliminary testing of antibody clones identified under progress.
- 
**Ongoing collaboration with TCS to identify SARS-CoV-2 main protease inhibitors**
- 
**SARS-CoV-2 pseudovirus assay for research collaborations**



## Our Science Has Contributed To Fundamental Knowledge

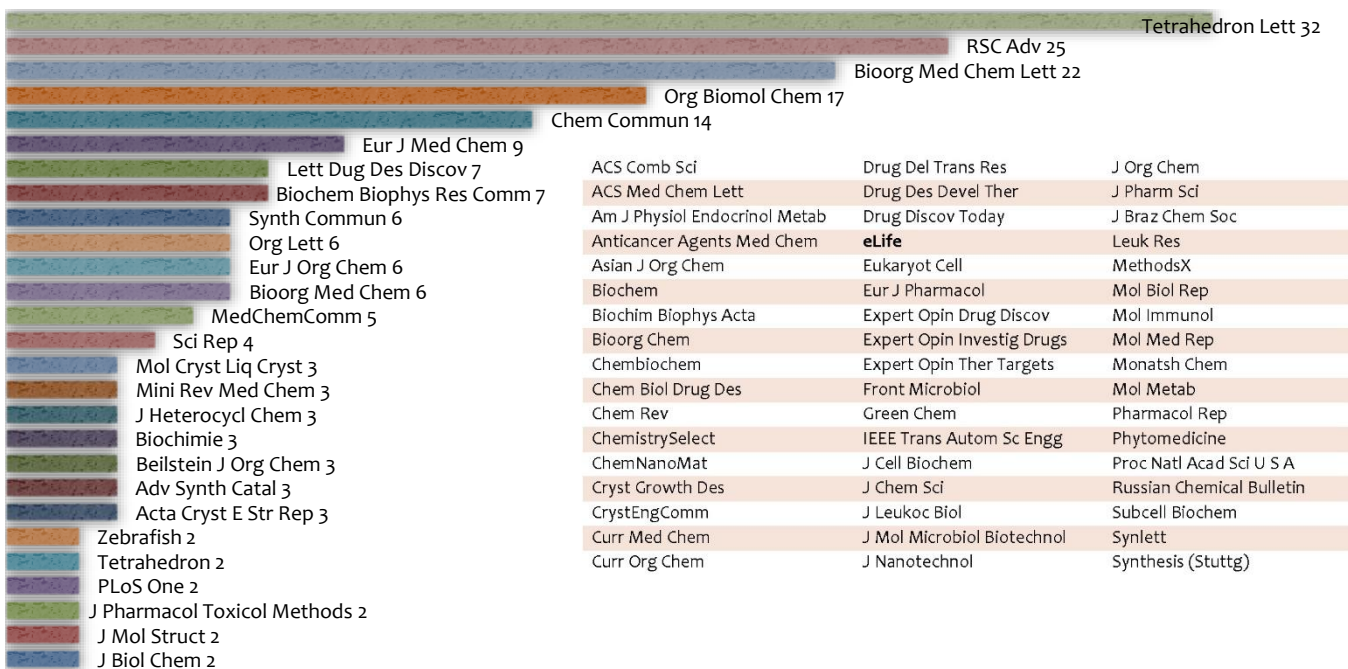
- 🔍 Identification of important novel signaling pathways in inflammatory responses
- 🔍 Small molecule inhibitors for arthritis and psoriasis
- 🔍 Targets in Tuberculosis treatment
- 🔍 Better understanding of Type 2 Diabetes and insulin resistance
- 🔍 Disease models in zebrafish focusing on tyrosine kinases
- 🔍 CRISPR-Cas9 Technology
- 🔍 New synthetic methodologies in catalyzed, multi-component, and cascade reactions, and C-H/amino group activation
- 🔍 Nanochemistry in chemical catalysis and biological processes



Science

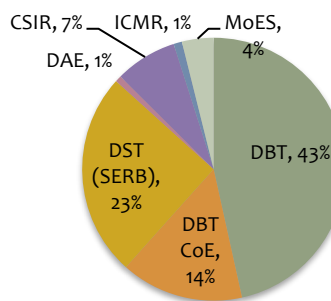
## Our Science Has Consistently Stood The Test Of Peer Review

We have published over 270 articles since the year 2010 contributing to an institutional h-index of 20.



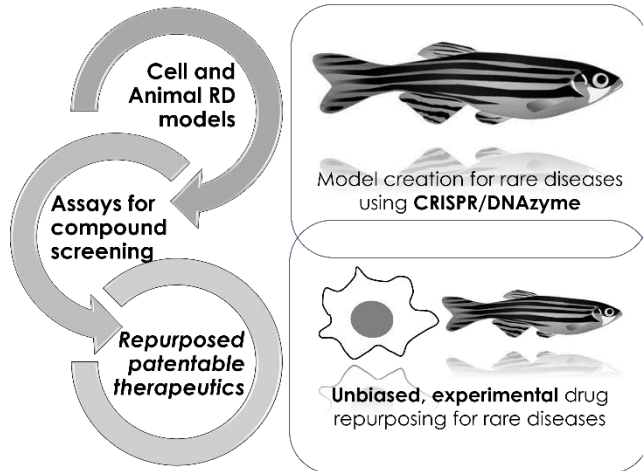
## Research Supported Through Government Grant Funding

We have received more than 55 grants since 2010, representing funds exceeding ₹22 Cr.



## DRILS Rare Disease Research Initiative

A Rare Disease (RD) affects a small subset of the population (usually <1 in 2000) and mostly has a genetic cause. Rare diseases of current interest to us include Fragile-X syndrome, Musculo-skeletal disorders, Duchenne muscular dystrophy (DMD), Lysosomal storage disorders, Mitochondrial diseases and Inborn errors of metabolism (Glutaric Aciduria I).



Rare disease research activities at DRILS can be classified into three main categories:

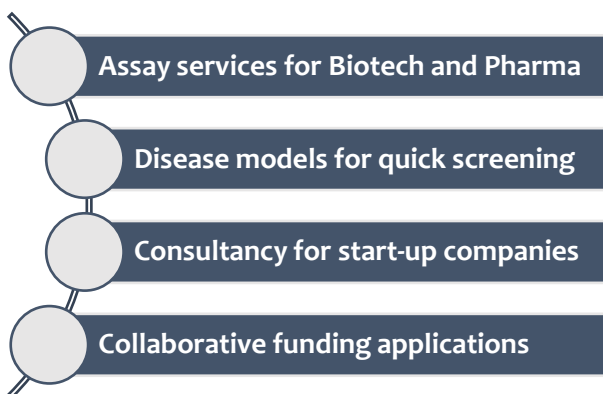
🧬 Disease models and assays in cell lines and model organisms to identify novel or untested targets for specific rare diseases.

🧬 Unbiased screening of a large and diverse set of small molecule classes (scaffolds), in throughput assays relevant to rare disease therapy, to identify repurposing candidates.

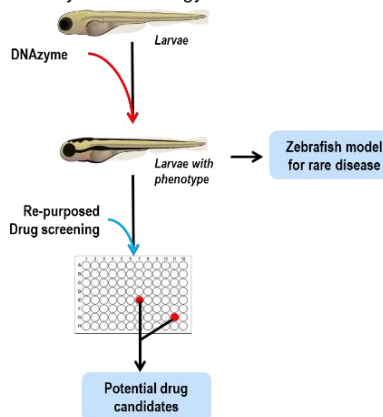
🧬 Use of large-scale datasets and computational analysis to uncover new, unexpected pathways and targets that may be of therapeutic relevance.

### DRILS Capabilities:

- State of the art Zebrafish facility
- Stable Zebrafish and cell line models lines using CRISPR technology
- Patented DNAzyme platform technology for rapid, inexpensive model creation in Zebrafish
- Assays for drug screening
- Pipelines for drug repurposing using AI/ML approaches
- Chemistry approaches for small molecule design and synthesis



### DNAzyme technology for model creation



## DRILS Rare Disease Research Initiative



A round-table meeting “Perspectives on rare disease research in India” was held at DRILS, Hyderabad on October 31st, 2019. The meeting was well-attended by clinicians and subject matter experts from various organizations in Hyderabad as well as from other parts of the country.

Key take-aways were to initiate collaborative efforts between hospitals and DRILS to conduct advanced research on rare diseases, to develop models and assays for rare diseases and to pursue drug development and repurposing efforts.

DRILS is part of two multi-center grants of high value with a focus on rare disease research, diagnosis and training. These grants are expected to accelerate rare disease research and training at DRILS as well as nationwide.

DBT/Wellcome Trust India Alliance

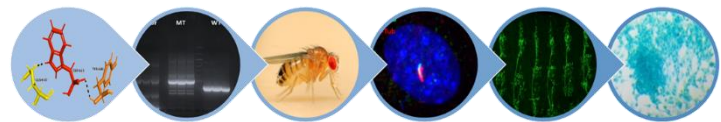


**Collaborators:**

KMC, Manipal; **DRILS, Hyderabad**; IOB, Bangalore

ICMR

Virtual Research Centre For Rare Monogenic Disorders in India

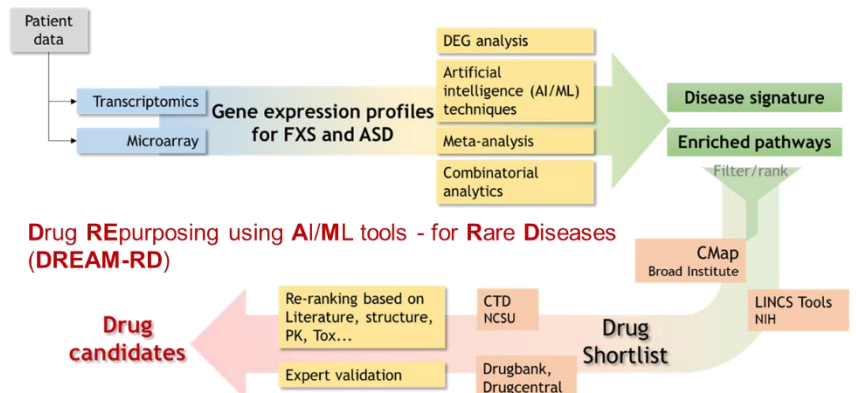


**Collaborators:**

SGPGIMS, Lucknow; AIIMS, New Delhi; CDFD, Hyderabad; KMC, Manipal; GRIPMER, New Delhi; **DRILS, Hyderabad**; IOB, Bangalore

**Role of DRILS:** Development of cellular and zebrafish models of rare diseases and functional characterization

DRILS scientists have developed a novel computational pipeline to prioritize candidates for drug-repurposing based on transcriptome changes, specifically for rare diseases. Case studies with Fragile-X syndrome and Duchenne Muscular Dystrophy are ongoing.





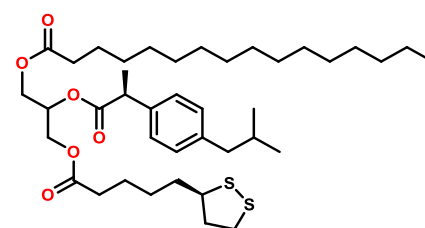
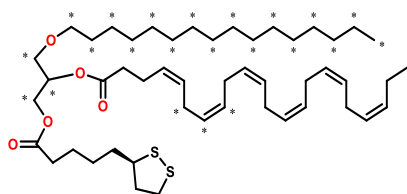
Industry

## Our Work Has Led To Several Industry Patents

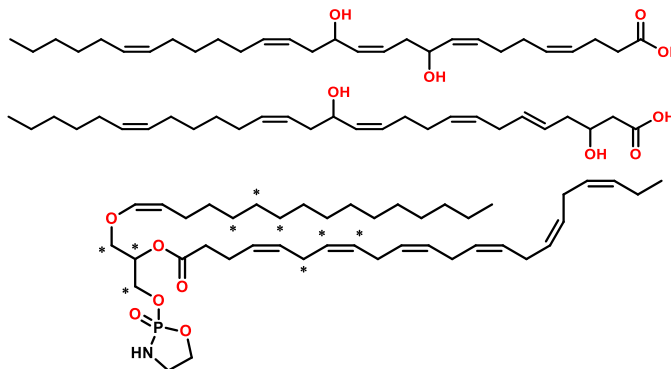
Ribociclib and salts, WO 2018051280  
 Ceritinib and intermediates, WO 2016199020  
 Idelalisib and intermediates, WO 2016108206  
 Vilazodone hydrochloride and free base, US 10011590B2  
 Regorafenib and polymorph, WO 2015011659  
 Suvorexant and intermediates, WO 2015008218  
 Fingolimod and salts, US 9216943B2  
 Telaprevir intermediates, WO 2014045263  
 Boceprevir intermediates, WO 2013190509  
 Saxagliptin and salts, WO 2013175395 A3  
 Mirabegron and intermediates, IN 2221/CHE/2012 A

## We Have Created Significant Value For Our Partners Through Science-Driven Innovation

DHA – Synthesis & optimization (<sup>13</sup>C-labeled)  
 Glycerolipid – Amino acid/ Active Metabolite/Drug Conjugates  
 Glycerolipid-DHA Conjugates (Cold & <sup>13</sup>C-labeled)

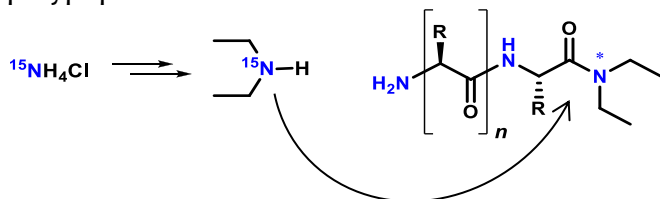


Biomarker Lipids

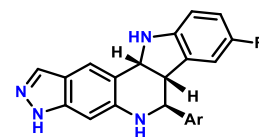
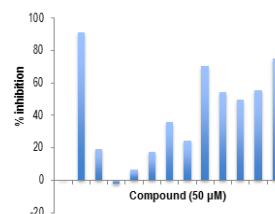


Plasmalogens and Glyceryl Phosphorylethanolamine Derivatives (Cold & <sup>13</sup>C-labeled)

Synthesis of <sup>15</sup>N-labelled compounds for polypeptide mixture characterization



Synthesis of small molecule N-rich heterocycles as potential Sirtuin inhibitors



### KEY INDUSTRY-ORIENTED RESEARCH AREAS

Catalysis, Chiral or Complex Intermediates  
 Catalysts and Ligands, Flow Chemistry  
 Environmental impact and greener processes  
 HIV or Hep-C inhibitors, anti-infectives, anti-cancer compounds  
 Polymeric APIs and import-substituting excipients  
 Peptides, Biosimilars, Strain development, Fermentation technology

### SPECIALIZED PLATFORMS

High-Potency Chemical Synthesis  
 BSL-2, Zebrafish, RNA Aptamers

## Commitment to Sustainability

One of the key areas of research at DRILS is development of synthetic processes for end-to-end manufacturing with focus on sustainability being the path and the end goal.



DRILS co-hosted along with the University of Hyderabad the 11<sup>th</sup> Workshop of the IOCD group 'Chemists for Sustainability' (C4S) on 21-27 Jan 2020.

Seen from left to right: Dr. Srinivas Oruganti, Prof. Alain Krief (IOCD Executive Director), Prof. Stephen Matlin (IOCD Secretary) and Prof. Goverdhan Mehta.



DRILS hosted the 4<sup>th</sup> FCS Symposium & Demo Workshop

DRILS, in association with CSIR-IICT and RSC, organized a two-day international symposium ("Su" for Sustainability: Changing Paradigms in Process Innovation, 24-25 Feb 2020) to highlight innovations in chemistry and chemical engineering that have allowed lab scale reactions to be translated into greener large scale manufacturing.



**IP2TECH is a focused online platform that has been conceptualized to showcase IP-focused technologies developed either exclusively at DRILS or through strategic collaborations.**

It highlights the unwavering focus of DRILS to carry out research whose output will have a meaningful impact on the development of practical technologies and/or products.

- Embryonic zebrafish models using DNAzyme mediated knockdown
- Combination of Class 1 HDAC inhibitor and incretin receptor agonists to potentiate glucose stimulated insulin secretion and improve glucose tolerance and reduce obesity
- Preparation of novel 1H-pyrazolo[4,3-d]pyrimidines, their compositions, synthesis and methods of using them for treating tuberculosis
- Process for the synthesis of deuterated capsaicin, capsaicinoids and synthetic capsaicin analogs
- Heterocyclic compounds as 5HT<sub>2C</sub> agonists
- Heterocyclic compounds as lipoxygenase inhibitors
- Process for the preparation and identification of deuterated eugenol
- Continuous flow process for the preparation of polymerizable cationic monomer derivatives & precursors thereof

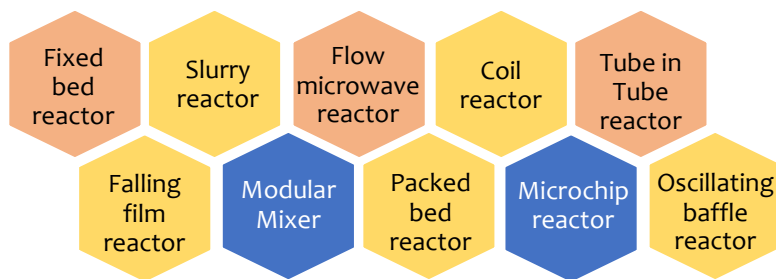
### Flow Chemistry Technology Hub (FCT-Hub)

**A DRILS proposed initiative for chemical innovation support to SMEs in Pharma to build indigenous capabilities in Flow Chemistry and its adoption towards continuous manufacturing.**

The key focus of the proposed FCT Hub is to accelerate the country's manufacturing capability as India pharma sector is posed to increase in the next 10 years to supply to the global demand. DRILS, with the help of the Govt. of Telangana, is proposing to be the country's key technology enabler hub to **Adopt, Design and Deploy (A.D.D.)** flow technology to accelerate the growth by using continuous manufacturing as the new norm across the nation's pharma.

#### Key Focus areas of the proposed hub

- Faster, cleaner & safer reactions.
- Rapid reaction optimization.
- Easy scale up, smaller footprint.
- Integrated synthesis, work up & analysis.



**FCT-Hub** aims to help pharma SMEs to **Brain-storm, Identify, Demonstrate, and Develop [BIDD]** sustainable processes which can translate into manufacturing with high levels of reproducibility

DRILS proactively established certain chemistries with the facility's available flow technology and is progressing towards establishing more by **BIDDing & ADDing** flow tech thereby enabling the proposed FCT Hub with a single point agenda to drive from a carbon neutral linear economy to a greener circular economy. In the current endeavor to realize the Hub, we are actively collaborating with some of the established flow chemistry research groups to bring in best of technologies available across the globe to the nation.



## Specific research outcomes in 2020-2021

### Research Grants:

#### Ongoing

Title	Agency	PI, Co-PI	Duration	Funding
Identification of the mechanistic basis of early striatal damage in Glutaric Aciduria Type I	DBT	Aarti Sevilimedu, Pushkar Kulkarni, Dr. A. Radha Rama Devi (Rainbow hospitals)	2018-2021	₹ 40,66,800
Identification of optimal therapeutic window for efficacious intervention in a Zebrafish model of Fragile X syndrome.	DBT	Aarti Sevilimedu, Pushkar Kulkarni, Kiranam Chatti	2019-2022	₹ 49,57,000
Design synthesis and evaluation of novel hybrid incretins to ameliorate Type 2 Diabetes	SERB	Prasenjit Mitra, Dr. Vishal Rai, IISER, Bhopal, Dr. Syed Ahamed Ibrahim (NIN)	2018-2021	₹ 30,41,800
Use of DNazymes to improve CRISPR-mediated knock-in	DBT	Kiranam Chatti Aarti Sevilimedu	2018-2021	₹ 65,84,000
Molecular analysis of the functional role of ser/thr phosphatase PHLPP in lipid induced formation of foam cells, a hallmark of atherosclerosis	DBT	Kishore Parsa Kiranam Chatti	2019-2022	₹ 56,24,998
A Microneedle Transdermal Patch for Supplementing Critical Micronutrients for Prevention and Control of Anemia	DBT	Marina Rajadurai, Parimal Misra Dr. B.R. Shamanna (UoH) Dr. C. T. Anitha (UoH)	2020-2023	₹ 67,90,920
Molecular characterization of the functional role of ser/thr phosphatase PHLPP in pancreatic beta cells to gain mechanistic insights into diabetes	SERB	Kishore Parsa Parimal Misra, Pushkar Kulkarni Prof. Prakash Babu (UoH) Dr. Sasiskala M (AIG-AHF)	2020-2023	₹ 54,94,004
Understanding the functional role of co-activator binding protein PIMT in adipogenesis and obesity	DBT	Parimal Misra, Kishore Parsa Prof. Satyamoorthy (MAHE) Dr. Manjunath Joshi (MAHE)	2020-2023	₹ 64,21,533
Synthesis of Anticancer Drug Trabectedin and Related Analogues	SERB	Ramesh Samineni	2020-2022	₹ 25,74,365
Studies on the role of HDAC inhibitors in reprogramming cancer cell metabolism to reverse cisplatin resistance in patient derived xenograft model of ovarian cancer.	ICMR	Prasenjit Mitra (Co-PI) , Dr. Vasudha Devi (Pharmacology MMMC, MAHE PI) Dr. Naveena AN Kumar (MAHE, Co-PI, KMC, Surgical Oncology)	2021 - 2024	₹ 27,00,000

## Recommended

A pre-clinical lead optimization study of adjunct medicaments for reducing duration and increasing efficacy of anti-tuberculosis drug therapy	DBT	Prof. Hasnain (Coordinator), Manojit Pal (PI), Nasreen Ethesham (PI) Parimal Misra ( Co-PI) and Kishore Parsa (Co-PI)	Recommended for funding
Virtual Centre for Functional Genomics of Novel Sequence variants in Genes for Rare Monogenic Disorders in India	ICMR	Dr. Shubha Phadke (SGPGIMS), Dr. Ashwin Dalal (CDFD), Dr. Girisha KM (KMC), Dr. Madhulika Kabra (AIIMS), Dr. Ratna Dua Puri (Sir Ganga Ram Hospital), Dr. Neeraj Gupta (AIIMS) and Kiranam Chatti (DRILS)	Recommended for funding.
Center for Rare Disease Diagnosis, Research and Training	IndiaAlliance/Wellcome-DBT	Dr. Girisha KM (MAHE), Dr. Akhilesh Pandey (IOB ), Aarti Sevilimedu (DRILS)	Recommended for funding, awaiting sanction letter

## Under review

Molecular analysis of the functional role of co-activator binding protein PIMT in macrophage mediated insulin resistance in rodents and humans	DBT	PIs: Parimal Misra (DRILS); Dr. Partha Chakrabarti, IICB, Kolkata; Co-PIs: Kishore Parsa (DRILS) and Dr. Om Tantia (ILS Groups of Hospitals, Kolkata)	₹ 1, 55, 59, 200
Role of bile acid signaling in liver development and growth: A knock-out study in zebrafish	SERB	PIs: Kiranam Chatti (DRILS); Dr. Savneet Kaur, ILBS (Institute of Liver and Biliary Sciences) New Delhi. Co-PIs: Pushkar Kulkarni (DRILS); Dr. KB Patel, ILBS	₹ 97,27,440
Studies on the order and chaos at the insulin gene locus: its impact on glucose-stimulated insulin secretion upon incretin receptor activation	SERB	PI: Prasenjit Mitra (DRILS) Co-PIs: Dr Sreenivaslu Kurukuti (UOH); Dr. Kanchan Garai (TIFR, Hyderabad)	₹ 80,00,000
Understanding the regulatory role of co-activator binding protein PIMT in the pancreatic b-cells of diabetic animals and T3C diabetic (Chronic pancreatitis) humans	DST-SERB	PI: Parimal Misra (DRILS); Co-PIs: Dr. Partha Chakrabarti, IICB, Kolkata; Kishore Parsa (DRILS) and Dr. Sasikala M (AIG)	₹ 99,18,360

Functional Analysis of PHLPP1 in Myogenesis: Implications for skeletal muscle dystrophies	DBT	PI: Kishore Parsa (DRILS) Co-PIs: Aarti Sevilimedu (DRILS); Kiranam Chatti (DRILS)	₹ 99,33,220
A study of overlap of genetic, epigenetic and environmental factors in autism spectrum disorders using a zebrafish fragile-X FMR knockout model	DST	PI: Pushkar Kulkarni (DRILS) Co-PIs: Aarti Sevilimedu (DRILS), Kiranam Chatti (DRILS)	₹ 78,00,000
Preparation and evaluation of a novel combinational therapy transdermal patch prototype for treatment of hyperglycemia in the rodent model of Type 2 Diabetes	DST-SERB	PI: Marina Rajadurai (DRILS) Co-PI: Prasenjit Mitra (DRILS)	₹ 65,70,696
Total Synthesis of Bioactive Peptide Natural Products Cladoamides A and Asperphenin B, Analogues for Anticancer Activity	SERB	PI: Ramesh Samineni (DRILS) Co-PI: Kiranam Chatti (DRILS)	₹ 51,22,389

## Research output (2020-2021):

### Publications:

- Sonochemical synthesis of rosuvastatin based novel 3-methyleneisindolin-1-one derivatives as potential anticancer agents. J. S. Kumar, G. S. Reddy, R. Medishetti, A. Ray, S. D. Bele, K. A. Hossain, B. Thirupataiah, R. K. Edwin, P. Behera, A. Joseph, G. G. Shenoy, C. M. Rao, M. Pal. *Journal of Molecular Structure* 2021, 1240, 130574 <https://doi.org/10.1016/j.molstruc.2021.130574>
- PdCl<sub>2</sub>-catalyzed synthesis of a new class of isocoumarin derivatives containing aminosulfonyl / aminocarboxamide moiety: First identification of a isocoumarin based PDE4 inhibitor. B. Thirupataiah, G. Mounika, G. S. Reddy, J. S. Kumar, K. A. Hossain, R. Medisetti, S. Samarpita, M. Rasool, J. Mudgal, J. E. Mathew, G. G. Shenoy, C. M. Rao, K. Chatti, K. V. L. Parsa, M. Pal. *European J. Chem* 2021, <https://doi.org/10.1016/j.ejmech.2021.113514>
- Tuning the sensitivity towards mercury via cooperative binding to D-fructose: dual fluorescent chemosensor based on 1,8-naphthyridine-boronic acid derivative. Marina Rajadurai\* and E. Ramanjaneya Reddy. *RSC Advances*, 2021, 11, 14862 – 14870.
- G. S. Reddy, J. S. Kumar, B. Thirupataiah, K. A. Hossain, S. B. Nallapati, V. B. Giliyaru, R. C. Hariharapura, G. G. Shenoy and M. Pal, Propargylamines in Pd/Cu-catalyzed tandem coupling-cyclization-N-deprotection in a single pot: Construction of N-unsubstituted vs N-sulfonyl indole ring. *Tetrahedron Lett.* 2021, 77, 153213 <https://doi.org/10.1016/j.tetlet.2021.153213>
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- MS-275, a Class 1 Histone Deacetylase Inhibitor Augments Glucagon-Like Peptide-1 Receptor Agonism to Improve Glycemic Control and Reduce Obesity in Diet-Induced Obese Mice. Shilpak Bele, Shravan Babu Girada, Aramita Ray, Abhishek Gupta, Srinivas Oruganti, Phanithi Prakash Babu, Rahul SR Rayalla, Shashi Vardhan Kalivendi, Ahamed Ibrahim, Vishwajeet Puri, Venkateswar Adalla, Madhumohan R Katika, Richard DiMarchi, Prasenjit Mitra. *eLife* 2020;9:e52212 doi: [10.7554/eLife.52212](https://doi.org/10.7554/eLife.52212) Dec 22, 2020.
- Kavitha Agastheeswaramoorthy, Aarti Sevilimedu. Drug REpurposing using AI/ML tools - for Rare Diseases (DREAM-RD): A case study with Fragile X Syndrome (FXS). *bioRxiv* 2020.09.25.311142; 2020. doi: <https://doi.org/10.1101/2020>.
- Novel isatin-indole derivatives as potential inhibitors of chorismate mutase (CM): their synthesis along with unexpected formation of 2-indolylmethylamino benzoate ester under Pd-Cu catalysis. Gangireddy Sujeevan Reddy, Kazi Amirul Hossain, Jetta Sandeep Kumar, B. Thirupataiah, Rebecca Kristina Edwin, Varadaraj Bhat Giliyaru, Raghu Chandrashekar Hariharapura, G. Gautham Shenoy, Parimal Misra and Manojit Pal. *RSC Advances* 2020, 10, 289, doi: 10.1039/c9ra09236f.
- Indole derivatives as anti-tubercular agents: An overview on their synthesis and biological activities. Gangireddy Sujeevan Reddy and Manojit Pal, *Curr. Med. Chem.* 2020, accepted.
- A DNAzyme based knockdown model for Fragile-X syndrome in zebrafish reveals a critical window for therapeutic intervention. Medishetti R, Rani R, Kavati S, Mahilkar A, Akella V, Saxena U, Kulkarni P\*, Sevilimedu A\*. *J. Pharmacol Toxicol Methods.* 2020,101, 106656. doi: 10.1016/j.vascn.2019.106656.
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- Inhibiting fusion with cellular membrane system: therapeutic options to prevent severe acute respiratory syndrome coronavirus - 2 infection. Prasenjit Mitra. *Am J Physiol Cell Physiol* 2020, 319: C500. doi:10.1152/ajpcell.00260.2020

#### Book chapter

- Pal S., Pal M. (2021) Anti-diabetes Research in India: Contributions from Industrial Organizations. In: Dikshit M. (eds) Drug Discovery and Drug Development. Springer, Singapore. [https://doi.org/10.1007/978-981-15-8002-4\\_8](https://doi.org/10.1007/978-981-15-8002-4_8)

#### Patents:

- M. Rajadurai, Bhavya Surekha, Sustained Release Compositions. PCT, No.: E-5/1816/2021/CHE, filed on May 18, 2021.
- B. Thirupataiah, G. Mounika, K. V. L. Parsa, M. Pal, Bicyclic compounds as PDE4 inhibitors. Indian Patent Application No.: 202041042403 filed on September 29, 2020.
- PCT entered National Phase in the US, Request for Examination filed in India. Embryonic Zebrafish models using DNAzyme mediated knockdown. Sevilimedu A and Kulkarni P. PCT. 2019. Publication number: WO/2019/171191, International Application number PCT/IB2019/051255.



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- More than 200 students at the Bachelor's and Master's levels have been trained as part of short-term or year-long research projects.
- 🎧 A focused effort to conduct training programs has been under way under a Center for Advancement of Research Skills (CARS). Programs addressing Industry-relevant and Basic Science skills are being delivered. Industry R&D employees underwent workshops on advanced pharmaceutical analysis.
- 🎧 Students from post-graduate to high school level, and college teachers have participated in training programs designed to advance understanding and skills in fundamentals of modern biology.
- 🎧 During the COVID lockdown period in 2020, three web-based workshops were conducted for college students, college teachers, and high school students.

- Web-based Workshop on CRISPR for college teachers in July 2020
- Web-based summer internships for 12 high school students (9-11 grades) from Manthan School during May-June 2020
- Short course “Organic Chemistry for Chemical Engineers’: This course was rolled out as a Web-based training program for Dr. Reddy’s MSAT (Manufacturing Science and technology) team members (Support of L&D and HR teams).
- Summer internship for high school students from Manthan School, April-May 2021
- A Pilot Course on Quality Control (QC) in collaboration with Dr. Reddy’s TTO, Sep-Oct 2021



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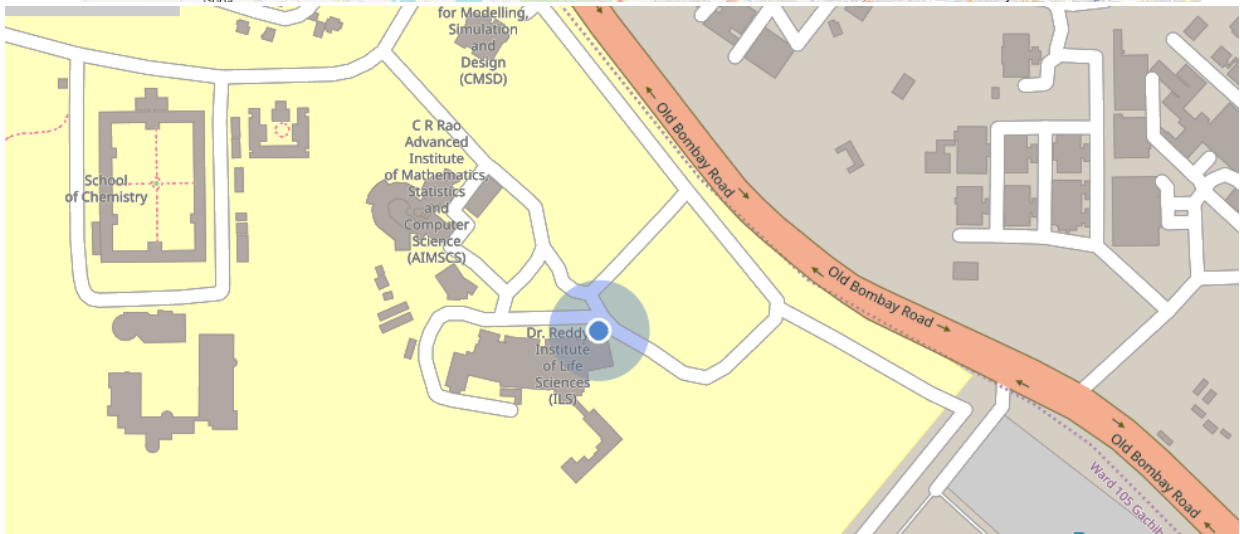
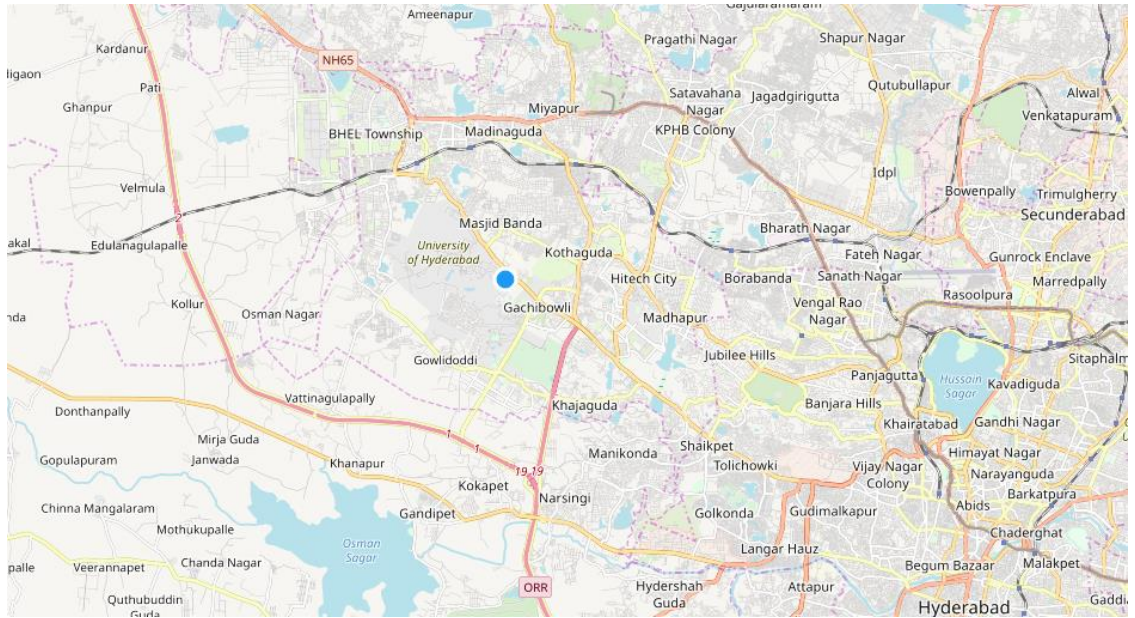
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