TRANSLATION, TECHNOLOGY TRANSFER AND PRODUCT DEVELOPMENT

Govindaraju Lab has licensed inventions for developing point-of-care diagnostic kits and therapeutics, and undertaken product development through approved translational projects.

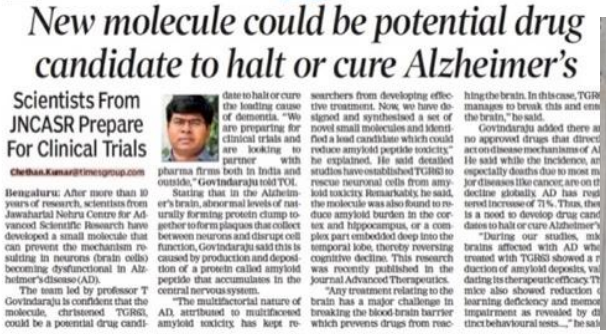
ALZHEIEMR'S THERAPEUTICS

A novel drug candidate (TGR63) discovered for the treatment of Alzheimer's disease. The efficacy of TGR63 is demonstrated in AD animal model which reverse cognitive decline. Advanced studies including clinical studies are planned with a pharmaceutical company.

This invention was highlighted by Kiran Mazumdar-Shaw (February 25 2021)

Highlighted in major newspapers and media/TVs

TIMES OF INDIA (February 2021)



New molecule could be potential drug candidate to halt or cure Alzheimer's

Scientists From JNCASR Prepare For Clinical Trials

Chethan.Kumar@timesgroup.com

Bengaluru: After more than 10 years of research, scientists from Jawaharlal Nehru Centre for Advanced Scientific Research have developed a small molecule that can prevent the mechanism resulting in neurons (brain cells) becoming dysfunctional in Alzheimer's disease (AD).

The team led by professor T Govindaraju is confident that the molecule, christened TGR63, could be a potential drug candidate to halt or cure the leading cause of dementia. "We are preparing for clinical trials and are looking to partner with pharma firms both in India and outside," Govindaraju told TOI.

Stating that in the Alzheimer's brain, abnormal levels of naturally forming protein clump together to form plaques that collect between neurons and disrupt cell function, Govindaraju said this is caused by production and deposition of a protein called amyloid peptide that accumulates in the central nervous system.

"The multifactorial nature of AD, attributed to multifaceted amyloid toxicity, has kept researchers from developing effective treatment. Now, we have designed and synthesised a set of novel small molecules and identified a lead candidate which could reduce amyloid peptide toxicity," he explained. He said detailed studies have established TGR63 to rescue neuronal cells from amyloid toxicity. Remarkably, he said, the molecule was also found to reduce amyloid burden in the cortex and hippocampus, or a complex part embedded deep into the temporal lobe, thereby reversing cognitive decline. This research was recently published in the journal Advanced Therapeutics.

"Any treatment relating to the brain has a major challenge in breaking the blood-brain barrier which prevents drugs from reaching the brain. In this case, TGR63 manages to break this and enter the brain," he said.

Govindaraju added there are no approved drugs that directly act on disease mechanisms of AD. He said while the incidence, especially deaths due to most major diseases like cancer, are on the decline globally, AD has registered increase of 71%. Thus, there is a need to develop drug candidates to halt or cure Alzheimer's.

"During our studies, mice brains affected with AD when treated with TGR63 showed a reduction of amyloid deposits, validating its therapeutic efficacy. The mice also showed reduction in learning deficiency and memory impairment as revealed by distinct behavioural sess...," he said.

THE HINDU (March 2021)

JNCASR team develops potential drug candidate for Alzheimer's

The team observed that the small molecule TGR63 reduced amyloid plaques in mice brains and reversed cognitive decline

DECCAN HERALD (February 2021)

Alzheimer's disease reversible? Bengaluru scientists say 'possibly'

AKHIL KADIDAL
BENGALURU, DHNS

Alzheimer's is one of the primary causes of dementia in people, and while the disease is considered irreversible, a cure may have been found by Bengaluru-based scientists.

The breakthrough is a small molecule which has shown the ability to disrupt the mechanism through which neurons become dysfunctional in Alzheimer's disease.

Developed by scientists from the Jawaharlal Nehru Centre for Advanced Scientific Research (JNCASR) and an Indian-origin scientist at the KTH Royal Institute of Technology in Sweden, the molecule, which has been called TGR63, has been shown in animal studies to not only halt the progress of the disease but even reverse it.

Alzheimer's in a person progresses through the abnormal buildup of naturally forming proteins which clump together to form plaques that collect between neurons and disrupt cell function.

Govindaraju

Researchers say this is caused by production and deposition of the amyloid peptide (A) that accumulates in the central nervous system. "The aggregation of this protein has the end effect of disrupting the neural network of the brain, resulting in memory loss and the destruction of thinking skills," said Prof T Govindaraju, from JNCASR.

"The multifactorial nature of Alzheimer's disease is attributed to multifaceted amyloid toxicity, which has kept researchers from developing effective treatment," an official release stated, adding that small molecule found by the team can reduce the toxicity of amyloid beta (A) toxicity, and in doing so, can rescue neuronal cells.

The molecule was also found to reduce amyloid burden in the cortex and hippocampus, or a complex part embedded deep into the temporal lobe, thereby reversing cognitive decline. The research has been published recently in the journal Advanced Therapeutics.

"Our animal studies show that mice with advanced stages of the disease can show a marked improvement in memory and thinking skills over a matter of days. In mice with early stages of the disease, recovery happened in a matter of hours," Professor Govindaraju told *DH*.

Video footage of tests showed a mouse with Alzheimer's treated with TRG63 and successfully navigating a Morris Water Maze from memory.

"However, we will only know the full scale of efficacy when human trials are conducted," Professor Govindaraju added.

Currently available treatments provide only temporary relief, and there are no approved drugs that directly act on the disease mechanisms of Alzheimer's.

Bengaluru

INDIAN EXPRESS (February 2021)

THE NEW INDIAN EXPRESS

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Home › States › Karnataka

JNCASR develops molecule that may help treat Alzheimer's

First identified over a 100 years ago, Alzheimer's disease has no major medicati till date that can assist in permanent treatment.

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Published: 25th February 2021 06:02 AM | Last Updated: 25th February 2021 06:02 AM

RAJASTHAN PATRIKA (Hindi) February 2021

10:49 PM

राजस्थान पत्रिका

अल्जाइमर के उपचार के लिए कारगर दवा विकसित होने की उम्मीद बढ़ी

Prasar Bharati Documentary on the invention

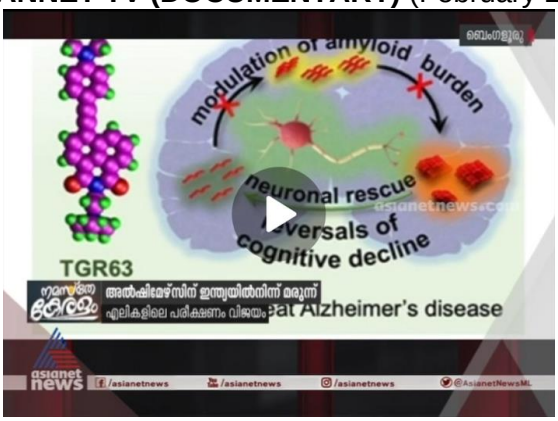
अल्जाइमर्स...
भारतीय वैज्ञानिकों को मिली बड़ी सफलता

(February 2021) https://youtu.be/UkIZwB84udU

THE ECONOMIC TIMES (February 2021)

ANI NEWS (February 2021)
https://youtu.be/4UJ1leSJgYk

ASIANNET TV (DOCUMENTARY) (February 2021)



LongevityTechnology

LONGIVITY-TECHNOLOGY (UK)

Researchers in India say they have discovered a promising drug target that may slow or even halt the progression of Alzheimer's.

Highlighted in major newspapers and media/TV

JNCASR Scientists develop a new molecule that could be a potential drug candidate for the treatment of Alzheimer's (PIB, GoI, February 24, 2021)

New molecule could be potential drug candidate to halt or cure Alzheimer's (Times of India, February 26, 2021)

Bengaluru scientists discovers possible cure for Alzheimer's, now seeking funding for clinical trials (ANI News, February 26, 2021)

Bengaluru scientists discover possible cure for Alzheimer's (ANI News, February 27, 2021)

Bengaluru-based scientists led by T Govindaraju discover possible cure for Alzheimer's (The Economic Times, February 27, 2021)

JNCASR team develops potential drug candidate for Alzheimer's (The Hindu, March 06, 2021)

JNCASR develops molecule that may help treat Alzheimer's (The New Indian Express, February 25, 2021)

Alzheimer's disease reversible? Bengaluru scientists say 'possibly' (Deccan Herald, February 27, 2021)

Bengaluru scientists discover molecule that could cure for Alzheimer's (Deccan Herald, February 26, 2021)

Scientists discover possible cure for Alzheimer's, seeks funds for trials (Hindustan Times, February 27, 2021)

JNCASR scientists develop molecule to halt dementia (The Pioneer, February 26, 2021)

Scientists develop new molecule that could halt, cure Alzheimer's (The Federal, February 26, 2021)

JNCASR develops potential drug candidate for Alzheimer's disease (The BioSpectrum, February 26, 2021)

Kiran Mazumdar-Shaw (February 26, 2021)

JNCASR Scientists Develop A New Molecule That Could Be A Potential Drug Candidate For The Treatment Of Alzheimer's. (The IndiaEducation Dairy.com, February 24, 2021)

JNCASR Scientists develop potential drug candidate for Alzheimer's treatment (Jagaran Josh, February 24, 2021)

JNCASR Scientists Develop a New Molecule for Treatment of Alzheimer's (SME Street, February 24, 2021)

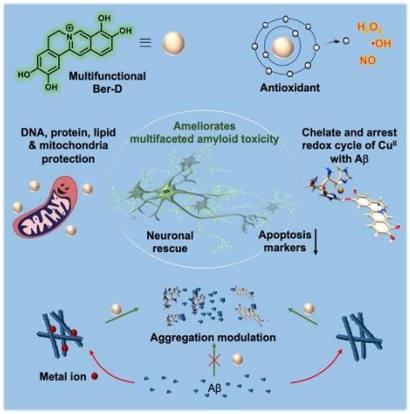
Indian Scientists Develop Novel Molecule That Could Be Potential Drug Candidate For Treatment Of Alzheimer's Disease (Swarjaya Magazine, February 24, 2021)

Behavioural studies show the reversal of cognitive decline in AD animal model.

https://onlinelibrary.wiley.com/action/downloadSupplement?doi=10.1002%2Fadtp.202000225&file=SupportingVideo3.avi
https://onlinelibrary.wiley.com/action/downloadSupplement?doi=10.1002%2Fadtp.202000225&file=SupportingVideo2.avi
https://onlinelibrary.wiley.com/action/downloadSupplement?doi=10.1002%2Fadtp.202000225&file=SupportingVideo1.avi

NATURAL PRODUCT BASED MULTIFUNCTIONAL INHIBITOR OF MULTIFACTED TOXICITY OF ALZHEIMER'S DISEASE

Our group has developed a natural product derivative that effectively ameliorate multifaceted amyloid toxicity both *in vitro* and *in cellulo* conditions. The multifunctional attributes makes it a promising candidate for developing effective therapeutics to treat multifaceted toxicity of Alzheimer's disease.



News highlights

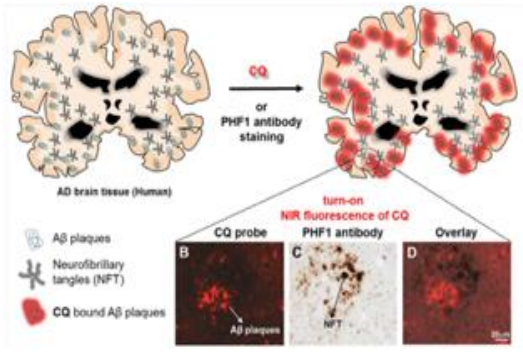
JNCASR scientists develop a natural product-based Alzheimer inhibitor (PIB, GOI; DST, GoI, April 2020)

Natural Product Based Alzheimer Inhibitor By JNCASR Scientists (Biotechnika, May 07, 2020)

Scientists at JNCASR develop berberine based Alzheimer's inhibitor "Ber-D" (Biotechnika, April 29, 2020)

JNCASR scientists develop a natural product based Alzheimer inhibitor (Pharmatutor, IBEF, GK Series, April 2020)

(IV) ALZHEIEMR'S DIAGNOSTICS (Translation)



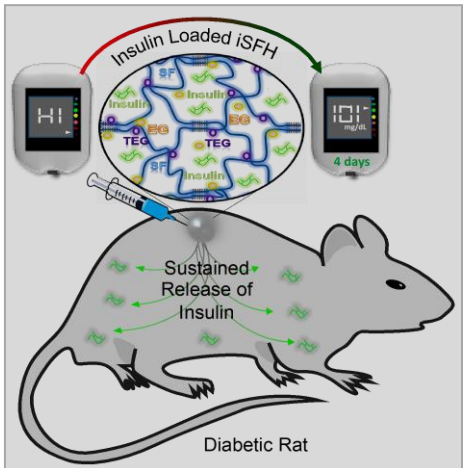
Our group has developed novel smart molecular tools with antibody selectivity and sensitivity, and methods for detection of Alzheimer's disease and to distinguish it from other neurodegenerative disorders (Unique technique to detect AD in case of mixed dementia). This invention is taken up for translation to develop affordable and early diagnosis for Alzheimer's disease (NIR/PET based brain imaging and detection of biomarkers in biofluids and retina) through the startup (VNIR Biotechnologies Pvt. Ltd.) founded by T. Govindaraju.

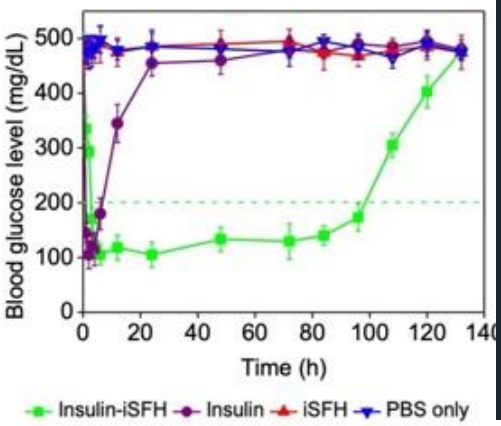
"**Health & Wellbeing Winner**" recognized by the **Commonwealth Chemistry** (UK) event (Federation of Commonwealth Chemical Sciences Societies) held across different continents and 38 countries.

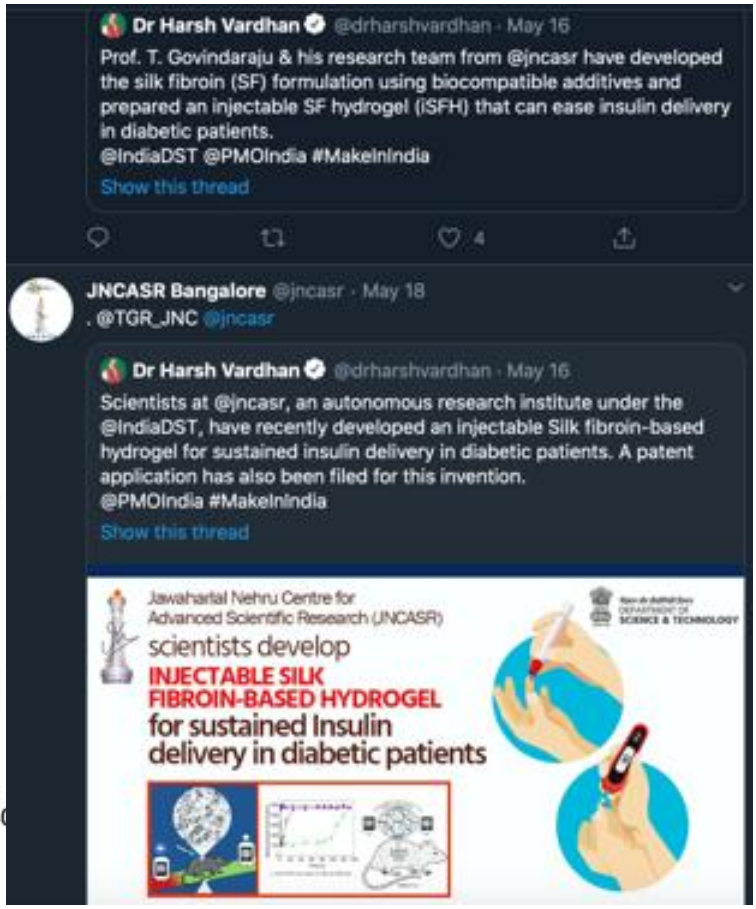
Alzheimer's disease (diagnosis) is profiled in Club SciWri (April 5, 2018)

(V) INJECTABLE SILK-BASED FORMULATION FOR SUSTAINED INSULIN DELIVERY

Diabetes (T1D and T2D) is a chronic disease affecting over > 70 million in India and > 400 million people worldwide. The conventional and last resort of treatment involves repeated subcutaneous insulin injections, which cause pain, local tissue necrosis, infection, nerve damage and locally concentrated insulin amyloidosis responsible for inability to achieve physiological glucose homeostasis. Our group developed silk-based formulation for controlled and sustained (maintaining normal glucose levels for 4 days/administration) insulin delivery and the invention being considered for translation for human use.







The importance and societal relevance (public health) of this invention were covered extensively,

JNCASR scientists develop injectable Silk Fibroin-based hydrogel for sustained Insulin delivery in diabetic patients (4 days sustainable insulin delivery) (DD News, May 15, 2020)

Dr. Harsh Vardhan, Honourable Minister for Minister of Health & Family Welfare, Science & Technology, Earth Sciences, GoI. (FB, May 16, 2020)

Dr. Harsh Vardhan, Honourable Minister for Minister of Health & Family Welfare, Science & Technology, Earth Sciences, GoI. (twitter, May 16, 2020)

Scientists develop injectable silk fibroin-based hydrogel for sustained insulin delivery in diabetic patients (Future Medicine, May 16, 2020)

JNCASR Scientists Innovate for Diabetic Patients (Medicircle, May 15, 2020)

Scientists develop injectable hydrogel for sustained insulin delivery in diabetic patients (The Poineer, May 15, 2020)

New injectable hydrogel may ease insulin delivery in diabetic patients (Asian Medical Tourism, May 15, 2020)

Sciesntists of JNCASR develop injectable silk-fibroin-based hydrogel for insulin delivery in diabetic patients (AffairsCloud, May 16, 2020)

JNCASR develops injectable silk fibroin-based hydrogel for diabetic patients (Devdiscourse News Desk, May 16, 2020)

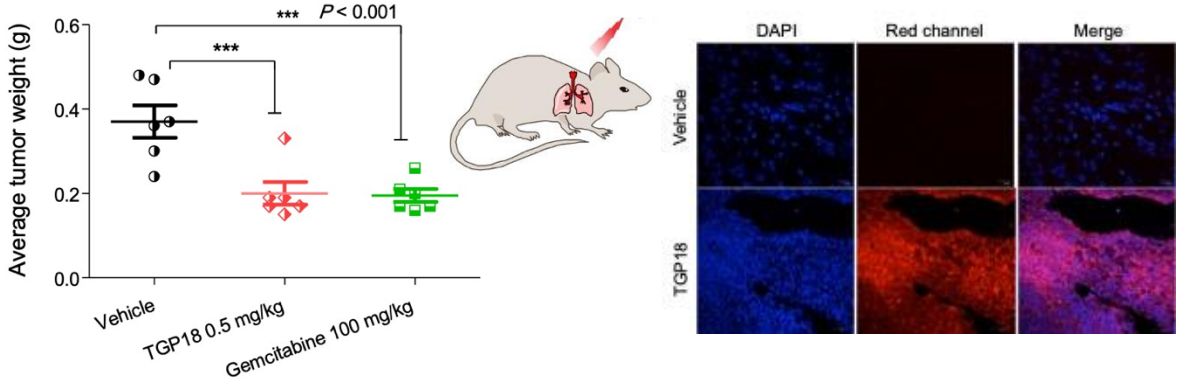
JNCASR develop injectable Silk Fibroin-based hydrogel for sustained Insulin delivery in diabetic patients (Freshers Live, May 15, 2020)

Diabetes Patients Will Get Rid Of Repeated Insulin (Hindi news, Rajasthan Patrika, May 31, 2020)

All India Radio Vijayawada news (AIRVijayawada news/TV, May 16, 2020)

(VI) DIAGNSOTIC THERAPY (THERANOSTICS) FOR LUNG CANCER

Lung cancer, the most common cause of cancer-related death worldwide is tough to detect at early stages, making it difficult to treat. Our group discovered a novel theranostic candidate TGP18 with anti-lung cancer activity and tumour tissue imaging potential (diagnosis and treatment of lung cancer). TGP18 is one of the first small molecule-based theranostic drug candidates for lung cancer with implications in personalized medicine. This invention has excellent clinical translational potential and in discussion with a pharma company for advanced toxicology and clinical studies.



This invention was highlighted by Kiran Mazumdar-Shaw and Dr. Harsh Vardhan, Honourable Minister for Minister of Health & Family Welfare, Science & Technology, Earth Sciences, GoI.

The importance and societal relevance of this invention for the detection and treatment of lung cancer is highlighted through extensive coverage

JNCASR researchers develop diagnostic therapy for Lung Cancer (DD News, September 02, 2020)

JNCASR researchers develop diagnostic therapyfor Lung Cancer (PIB, GOI, September 06, 2020)

JNCASR researchers develop diagnostic therapy for Lung Cancer (DST, GOI, September 02, 2020)

Dr. Harsh Vardhan, Honourable Minister for Minister of Health & Family Welfare, Science & Technology, Earth Sciences, GoI. (Twitter, September 03, 2020)

Kiran Mazumdar-Shaw (Twitter, September 08, 2020) (DST, GOI, September 02, 2020)

Dr. Harsh Vardhan, Honourable Minister for Minister of Health & Family Welfare, Science & Technology, Earth Sciences, GoI. (FB, September 03, 2020)

Indian researchers develop diagnostic therapy for lung cancer (Zee News, September 06, 2020)

Researchers develop therapy that can detect lung cancer at early stage (The Ecomonic Times, September 07, 2020)

JNCASR researchers develop diagnostic therapy for lung cancer (PharmaBiz, September 07, 2020)

JNCASR scientists develops novel diagnostic therapy for lung cancer (Biotechnika, September 07, 2020)

Indian researchers develop diagnostic therapy for lung cancer (Newstube, September 07, 2020)

JNCASR researchers developed diagnostic therapy for Lung Cancer (FreshersLive, September 07, 2020)

- Julolidine conjugates and methods for their preparation and use. US patent No. 8642764. Transferred to Intellectual Ventures (IV)
- Radical Scavenging antioxidant cyclic dipeptides and silk fibroin biomaterials (patent filed). Joint development agreement signed; technology has been shared with L'OREAL INDIA PRIVATE LIMITED.
- K. Rajasekhar (Int. Ph.D. student) work on "Near Infrared Fluorescence Probes for Diagnosis of Alzheimer's Disease**"** has been awarded with "**Gandhian Young Technological Innovation Award** (**GYTI 2017**)" and project for translation of the invention. and received the award at function organized at Rashtrapati Bhavan, New Delhi" and received funding for translation by **BIRAC-SRISTI**.
- M. B. Avinash's (Ph.D. student,) work on "Self-cleaning functional molecular material" has been appreciated with "**Gandhian Young Technological Innovation Award**" under "SRISTI Technological Edge/Strategic Innovation" category at Indian Institute of Management - Ahmedabad (IIM-A). This work was highlighted in newspaper *Bangalore Mirror* as "A self-cleaning surface that makes housework a cakewalk".