CENTRE FOR BRAIN RESEARCH

An autonomous Centre of the Indian Institute of Science

ANNUAL REPORT

2019-2020

CONTENTS

CBR at a Glance

The Centre for Brain Research (CBR) was established in 2014 at IISc to focus on research on ageing brain with a goal to identify risk and protective factors that contribute to healthy aging. Research at CBR represents an integrative approach encompassing genetic, imaging, molecular, functional, computational method, while bringing together large groups with diverse expertise to address the complex challenges of understanding brain functioning in health and disease. We faster large-scale research programs and build capacity focused on inter disciplinary neuroscience research in India. We believe this will set the stage for our scientists to contribute significantly to the endeavor of understanding the human brain and discovering rational therapies and cures for brain disorders, in addition to gaining insight about the complex cognitive and behavioral functions executed by the brain.

CBR is funded by Mr. Kris Gopalakrishnan, co-founder of Infosys and Mrs. Sudha Gopalakrishnan. CBR is immensely thankful for the philanthropic support that enables the transformational research.

Mandate and Vision

- Carry out basic research to understand brain function in health and disease.
- Foster focused research programs for inter-disciplinary neuroscience research to discover rational therapies for dementia and other age-related brain disorders.
- Networking of neuroscientists among institutions across the country, with emphasis on neurodegenerative disorders.

1. RESEARCH PROJECTS

Srinivaspura Aging, Neuro Senescence and Cognition (SANSCOG) study

CBR, in collaboration with National Institute of Mental Health and Neurosciences (NIMHANS), Indian Institute of Science (IISc) and Sri Devaraj Urs Academy of Higher Education & Research (SDUAHER), Kolar started the Srinivaspura Aging Neuro Senescence and COGnition (SANSCOG) study in Srinivaspura taluk, Kolar district, Karnataka. This is a first of its kind, large, cohort study in the rural Indian population (projected n=10,000) that follows an interdisciplinary, multimodal approach, including detailed clinical, neurocognitive, biochemical, genetic and neuroimaging assessments, to understand the risk and protective risk factors for dementia and related disorders. Recruitment for the study started in January 2018. The pilot phase of the study (n=1,000) was completed in March 2019 and the main phase of the study is now ongoing. The study progress for the period 1st April 2019 to 31st March 2020 is given below:

i. Recruitment:

SANSCOG: 928 new participants were recruited (total of 2,126 recruitments from the start of the study). As all the villages in first Primary Health Centre (PHC) – Dalasanur – were targeted, we have started recruitment from the villages of the next PHC – Nambihalli. The field team surveyed about 1100 houses in 11 new villages in Dalasanur PHC, out of which 10 were completely surveyed and 1 is nearing completion.

ii. Awareness & community engagement initiatives:

14 awareness camps were conducted in the villages served by Dalasanur and Nambihalli PHCs. 831 telephonic follow-up calls were done across 16 villages, to maintain regular interim contact with the recruited participants. This strategy of maintaining interim telephonic contact was subsequently revised to making in-person home visits once in 3 months, since participants seemed more receptive when they met in-person. In collaboration with NIMHANS, a sports day event and a brain health talk were also conducted to keep the community engaged.

iii. Assessments completed – baseline & follow-up

815 baseline assessments were completed (total of 1830 baseline assessments from the start of the study). 31 pilot follow-up assessments were done to provide us an idea of the participant retention rates in the study (total of 144 pilot follow-up assessments from the start of the study). From February 2020, we started the regular follow-ups and 12 follow-up assessments have been completed.

iv. Team expansion and training

To increase the number of assessments, the entire assessment team at Srinivaspura project office was expanded by recruiting and training staff from the local community itself, thus, building local capacity. Currently, two independent assessment teams carry out around 40 assessments

per week. The field team underwent re-training and a new field team office was set up at the Srinivaspura project office premises, for ease of communication and monitoring.

v. Improvements in data organization and quality control

Streamlining of daily QC checks on the field team data and mandatory uploading of the same in the database, was initiated. A system for daily scanning and storage of physical reports (ECG, refractometry, assessment checklists, etc.), weekly transmission from the Srinivaspura project office, and regular filing of the same at CBR was put in place, to prevent any data loss. Improved quality control procedures for the checking and transferring data were also implemented. Obtaining automatic digital output for ECG data, through seamless data transfer to a connected PC, through the Smart View ECG software, was done. Data streamlining such as integration of participant barcodes to equipment data that previously lacked them (ECG, Fundus photography), was also done.

vi. MRI centre:

A state-of-the art MRI centre, with a 3-Tesla Siemens Prisma scanner, was set up at IISc, funded by the Tata trusts. The facility started functioning since 20th Nov 2019 and 139 MRIs have been done till date. Magnetic Resonance Spectroscopy was introduced in our study protocol, tailored for precise detection of neurochemicals and metabolites such as glutamate, GABA, glutamine and lactate.

vii. Mobile unit:

As carrying out assessments at the participants' villages itself would make it much more convenient for them and improve our recruitment rates, especially in the remote villages, we decided to implement the idea of a mobile assessment unit. A suitable vehicle was identified (Force Traveller 4020 - Wide Body) and purchased. After completion of the registration formalities, the necessary modifications and fabrication of the vehicle was done to suit our study assessment needs. The mobile unit is now ready for deployment in Srinivaspura.

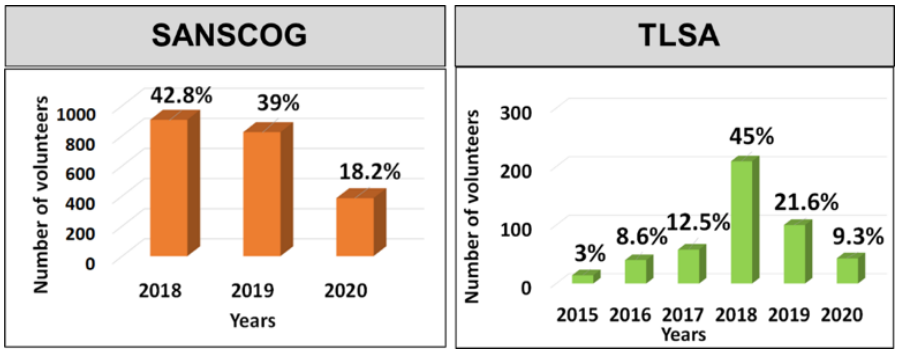
Table: SANSCOG study progress (1st April 2019 – 31st March 2020):

Title	1st April 2019 – 31st March 2020	Overall
Participants consented	928	2126
Villages recruited from	16	25
Baseline assessments	815	1830
Follow up assessments	12	12
Brain MRI	0	100
Interim telephonic + home visit contact	831	1208
Based on interim contact, participants interested in follow up	916	1117
Blood sample collection camps	22	45
Sample collection completed	811	1783
Feedback/consultation sessions completed	19	40
Village surveys	11	20
Awareness programs	14	31
Community engagement activities	4	4

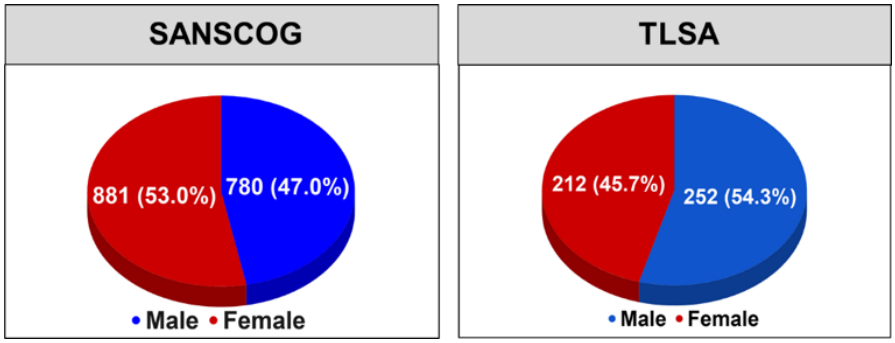
Preliminary results:

Preliminary data analysis of SANSCOG study data that was collected so far was done. Harmonization of the SANSCOG (rural) study with the parallelly-running urban study – Tata Longitudinal Study of Aging (TLSA) enabled us to make head-to-head comparison of the outcome measures, thus, giving valuable insights into the rural-urban differences in potential risk factors. In addition to the contrasting cohort characteristics, in terms of literacy level, languages spoken, etc., the prevalence of vascular risk factors such as diabetes, hypertension, obesity and dyslipidemia was much more in the urban (TLSA) cohort as compared to the rural (SANSCOG) cohort. There were significant differences observed in the biochemical parameters such as homocysteine, vitamin D and vitamin B12 as well. The summary of these preliminary results is represented in the below graphs:

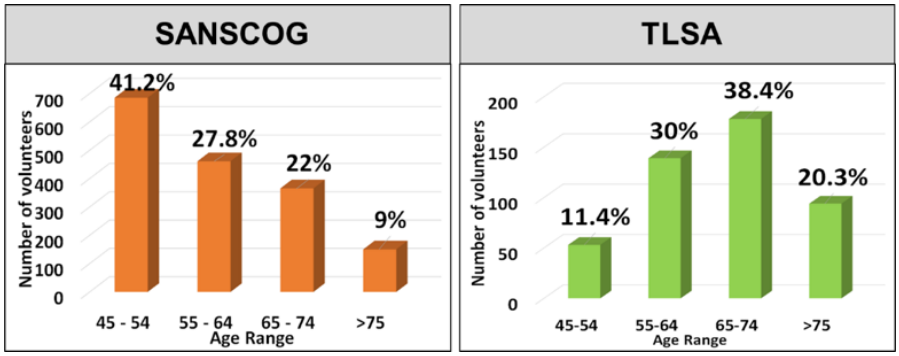
Year-wise recruitment



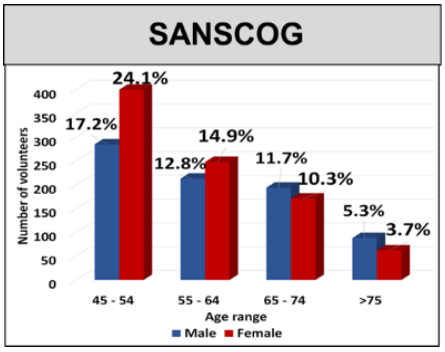
Gender distribution

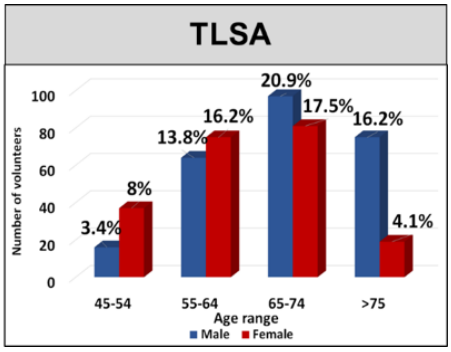


Age distribution

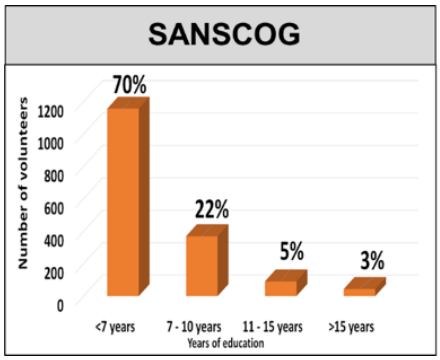


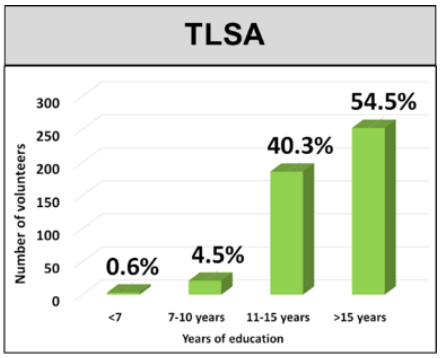
Gender-wise age distribution



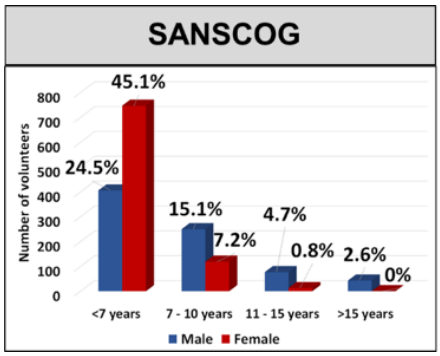


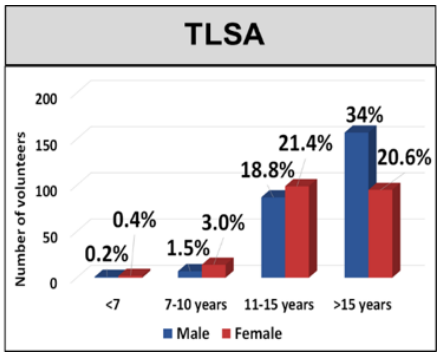
Years of education



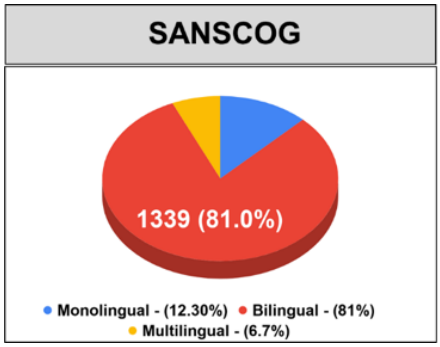


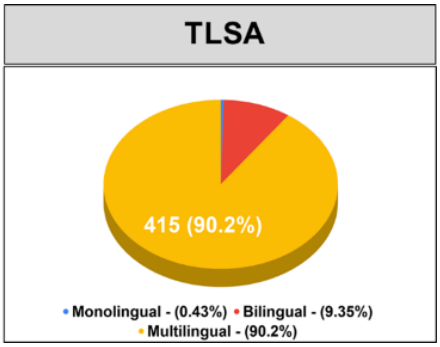
Gender-wise years of education



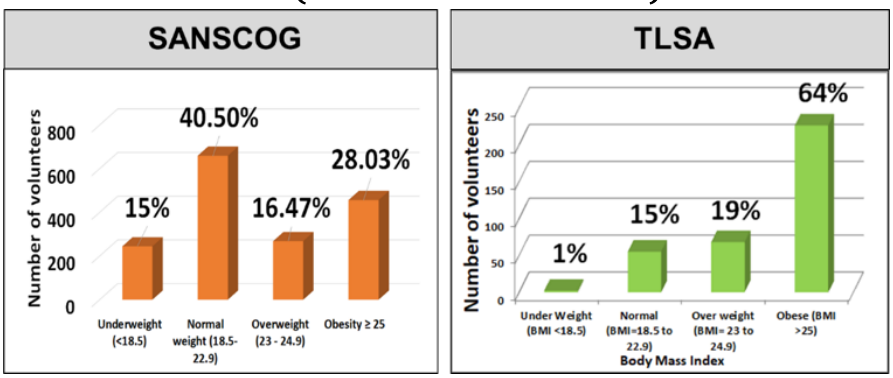


Language distribution

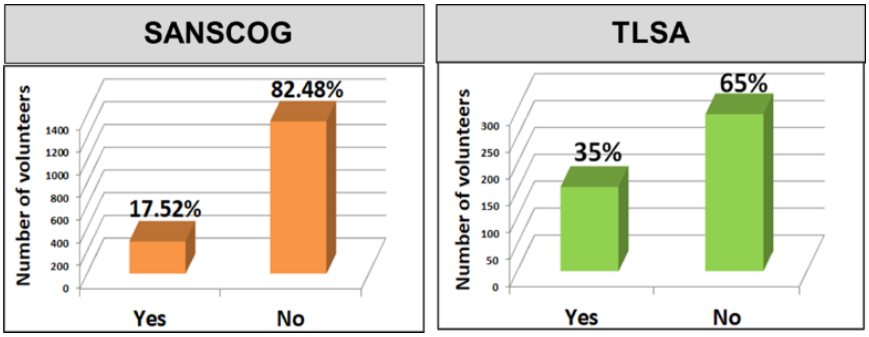




BMI (Asia-Pacific classification)

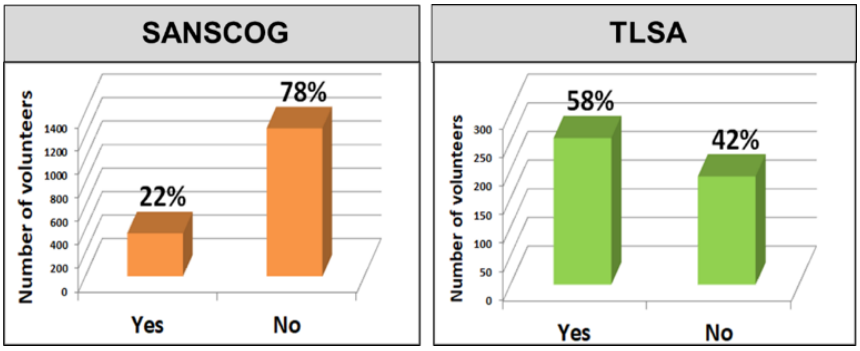


Diabetes*



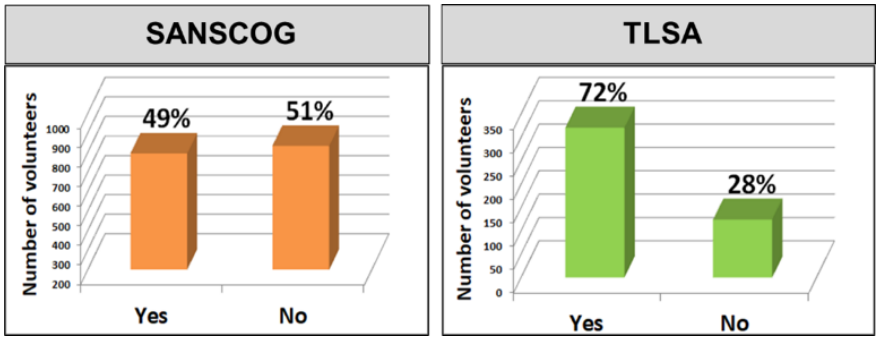
*Diagnosis based on self-report and/or Fasting Blood Sugar levels (FBS >/=126 mg/dl)

Hypertension (cut-off 140/90 mm Hg) *



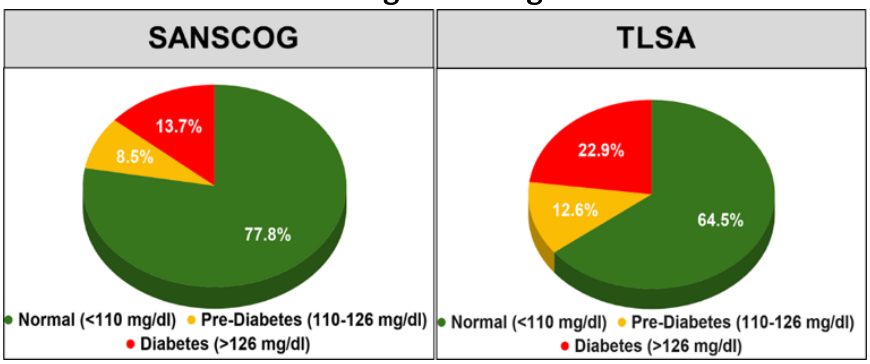
*Diagnosis based on self-report and/or blood pressure recording (systolic >/=140 mmHg, diastolic >/=90 mmHg)

Hypertension (cut-off 130/80 mm Hg) *

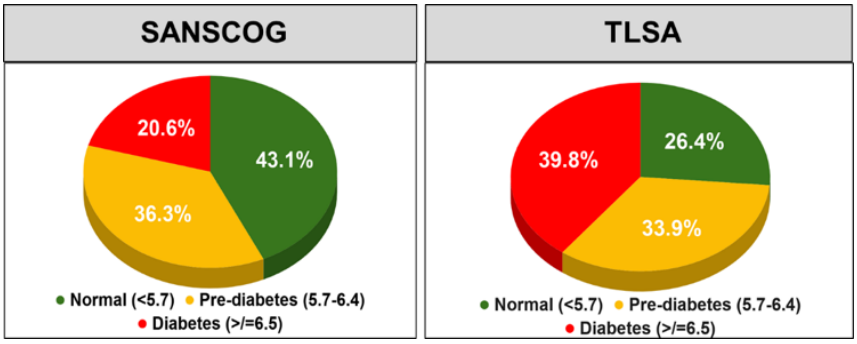


*Diagnosis based on self-report and/or blood pressure recording (systolic >/=130 mmHg, diastolic >/=80 mmHg)

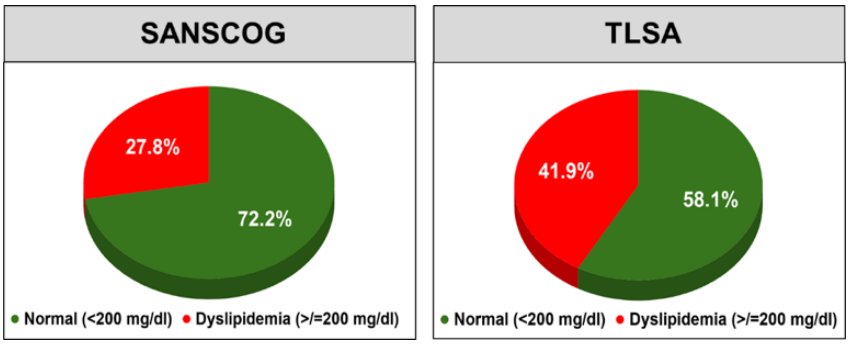
Fasting Blood Sugar



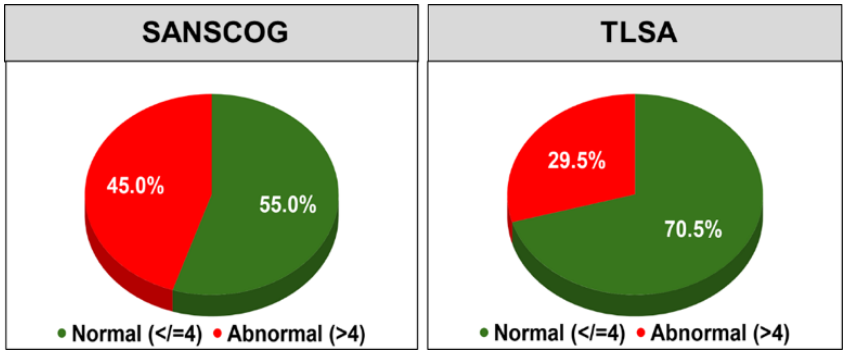
HbA1C



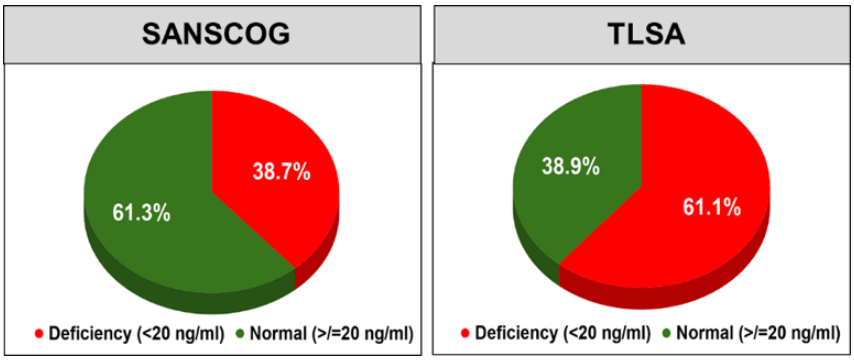
Total Cholesterol



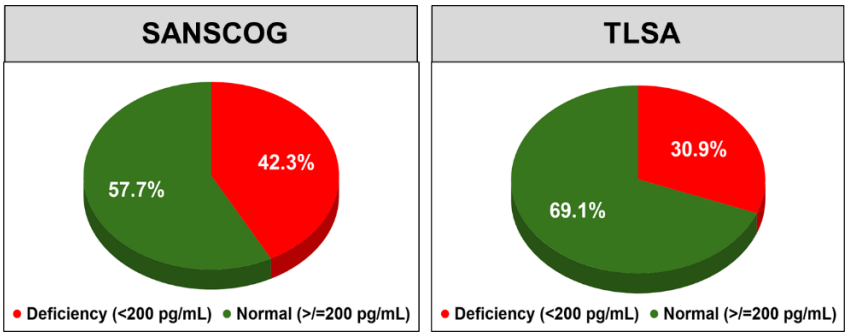
Triglyceride/HDL Ratio



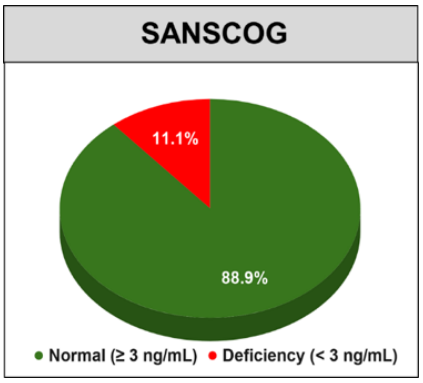
Vitamin D



Vitamin B12

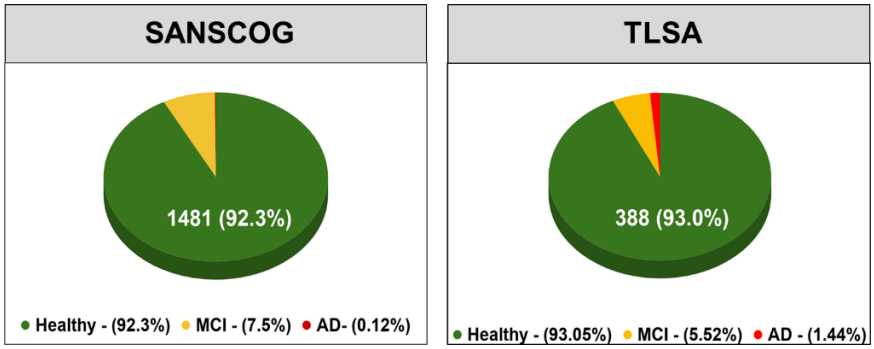


Folic Acid



*No data available for TLSA cohort (added recently)

Diagnosis of Dementia



*Diagnosis based on Clinical Dementia Rating (CDR) scale (0=Healthy, 0.5=MCI, >0.5=AD)

The GenomeIndia Project

CBR leads the consortium of 20 national institutes across the country for GenomeIndia project which is aimed at cataloguing the common and low frequency genetic variations in Indians by Whole Genome Sequencing (WGS) of 10,000 individuals in the first phase. In order to maintain population representation, these individuals are sampled from diverse ethnicities and linguistic communities across the length and breadth of the country.

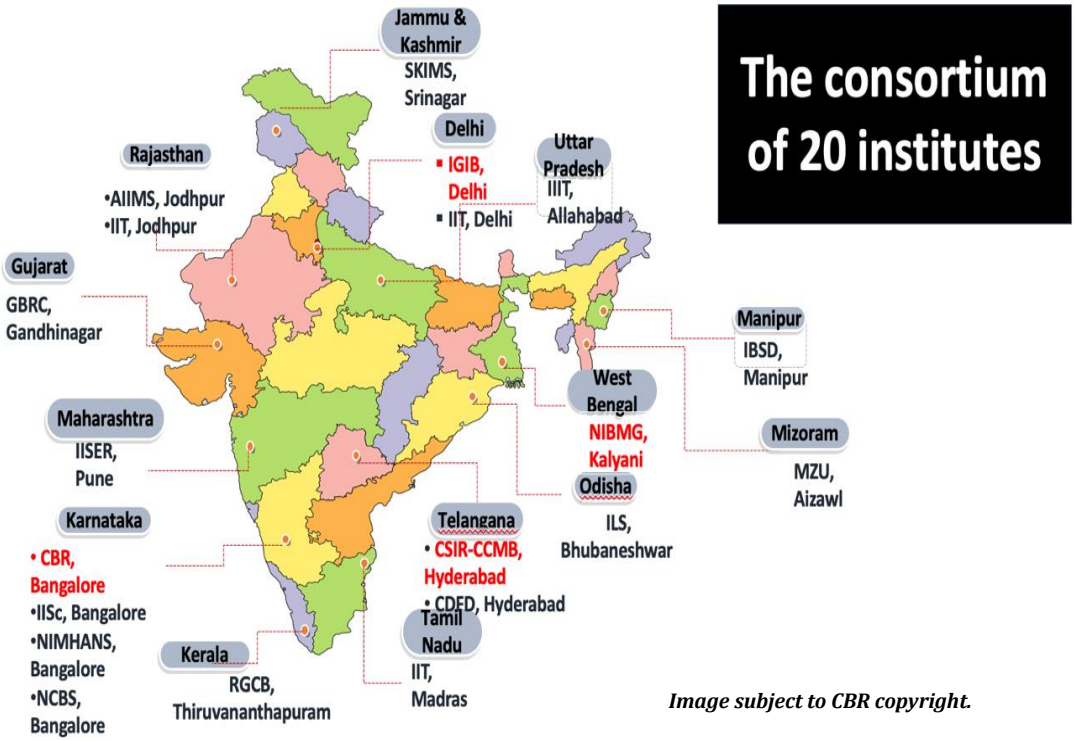
Genetic variations in individuals play crucial role in shaping our inherited traits, susceptibility to diseases, as well as track migration and evolution patterns. Populations across the world, depending on their geographic locations and ethnic background, differ in their genetic makeup in terms of allele frequency and haplotype structure that could determine, with contributions from environmental factors, their susceptibilities to complex genetic diseases. The Indian population consists of more than 4500 ethnic groups across the country, who follow their unique cultural practices, and have diverse linguistic affinities. This diversity coupled with endogamy has contributed to the genetic diversity of the current day Indian population. Thus, the Indian population harbor distinct variations and often many disease-causing mutations are amplified within some of these groups. Therefore, findings from population based or disease based human genetics research from other populations of the world cannot be extrapolated to Indians.

GenomeIndia project aims to identify the genetic variations (common, low frequency, rare, single nucleotide polymorphisms or SNPs, and structural variations) present in Indian population through whole genome sequencing of representative population groups across the country. This will lead to the development of a genome wide association chip specific for Indian population and facilitate large scale genetic studies in the future. This will help to identify the genetic variations in our population that makes us susceptible to complex diseases such as diabetes, cardiovascular diseases, obesity and mental illness, among others. The comprehensive list of genetic variation obtained from healthy individuals will serve as filter for non-causal mutations and help perform genetic studies on monogenic disorders. The results from this project would thus be a valuable national resource for the country and will be made publicly available through an interactive web portal.

Specific aims for the project are:

I) Create an exhaustive catalog of genetic variations (common, low frequency, rare, single nucleotide polymorphisms or SNPs and structural variations) in Indians.
II) Create a reference haplotype structure for Indians. This reference panel can be used for imputing missing genetic variation in future GWA studies.
III) Design genome wide arrays for research and diagnostics at an affordable cost.
IV) Establish a biobank for DNA and plasma collected for future use in research.

This project is led by Centre for Brain Research (CBR), with collaboration from nineteen other national institutes across India, including IISc, IITs, AIIMS, NIMHANS and leading basic science research institutes of the country.



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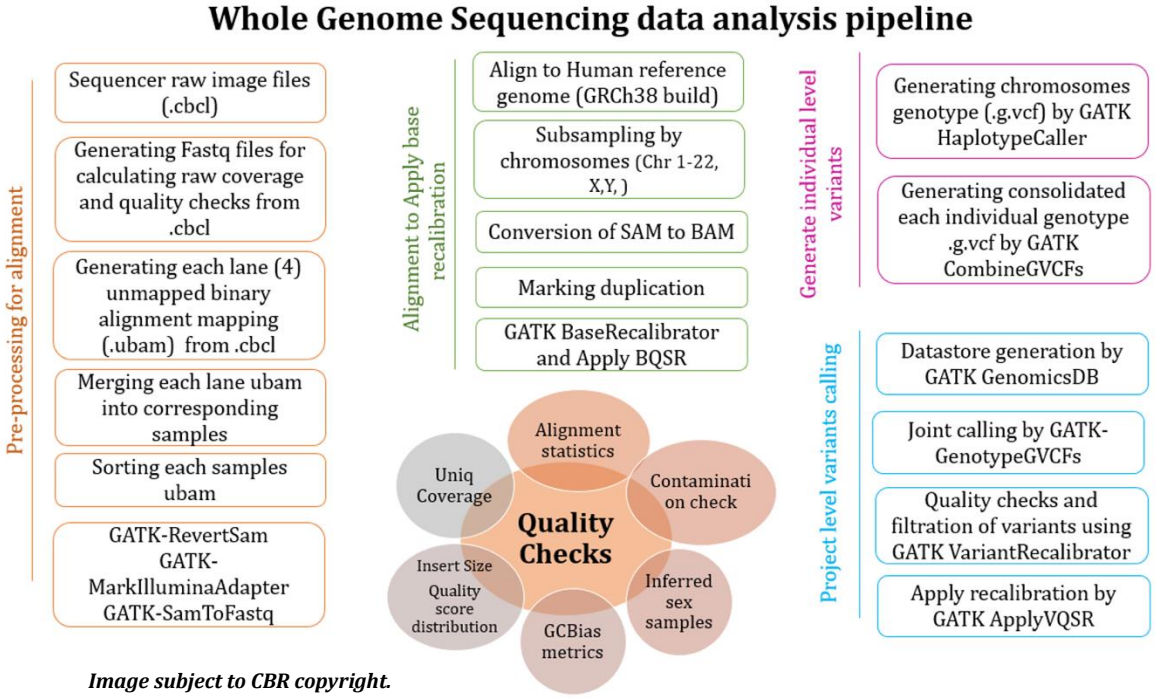
The project has been sanctioned by Department of Biotechnology, Government of India in January 2020. The total funding is for INR 240 crores. As part of this project, CBR has helped conduct several workshops in the partner institutions between January- March 2020 for population identification, community outreach and adhering to standard operating procedures for sample collection. Most importantly, one workshop was taught by instructors from Broad institute of MIT and Harvard who are part of the GATK and Terra developing team, the program suite used worldwide by various researchers for this purpose. Strategic international partnerships have been formed with acclaimed research groups already doing large scale WGS projects, namely, the BROAD institute of MIT and Harvard, Alzheimer's Disease Sequencing Project, JCVI and University of Pennsylvania.

About 300 individuals have already been recruited into the project. As part of the detailed phenotyping, these recruited individuals undergo anthropometric assessments, and blood biochemical investigations for: Glucose metabolism, Lipid profile, Liver function tests, Vit B12, Folate, Homocysteine, Vit D, Renal function tests, Cell counts (TLC, platelet), CRP, Insulin metabolism (insulin, C-peptide), and Haemoglobin.

CBR also has approved biobanking facility where biological samples, example, blood, plasma, serum and DNA will be stored in a cryo-preserved protected manner as per global standards.



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The next generation sequencing platform Illumina Novaseq 6000 for WGS has been established at CBR,IISc through funding from TATA Trusts. This facility is currently fully operational. The whole genomes of the recruited individuals have been sequenced in this platform, and currently being analyzed at CBR. The analytical pipeline is outlined below.

Apart from this, the Affymetrix high-throughput whole genome genotype scanner is currently fully operational at CBR and more than 2500 individuals' genomes have undergone genome level genotyping using Axiom Precision Medicine Research Array (PMRA) for GenomeIndia as well as other cohort studies conducted by CBR. Additionally, CBR proudly hosts a scalable storage system of 2 PetaBytes for data storage, and high-performance computing infrastructure of 170 Teraflops capacity, both are currently being doubled in capacity, that supports data analysis and storage of the massive amounts of multimodal data generated by human studies spearheaded by CBR.

Project personnel: Mr. Mohan C, Ms. Krithika Subramanian, Ms. Anupriya Sadhasivam, Mr. Abhishek Panda, Dr. Aarti Rana, Dr. Prathima Arvind, Mr. Rajesh G, Dr. Khader Valli Rupanagudi, Ms. Sunitha Rupanagudi, Mr. Mohammad Hanif Kaba Mujawar, Ms. Shobha Anilkumar.

Faculty Research:

Dr. Ganesh Chauhan

Project title: Genetic Risk Factors for Stroke and Cerebral Small Vessel Disease

Funding : Centre for Brain Research and DBT-Ramalingamswamy Fellowship

Project personnel : Mr. Shrihari A (PhD student)

Stroke is the most common cause of death worldwide after ischemic heart diseases. It is also the commonest cause for long term disability worldwide and a major cause of cognitive decline and dementia. Unlike stroke which is an "overt" form of the cerebral condition with apparent clinical symptoms, cerebral small vessel disease are "covert" forms of the disease with very few apparent clinical symptoms that go unnoticed for a long time. However, some of the markers of small vessel disease are apparent on brain MRI like white matter hyperintensities, brain infarcts, microbleeds and dilated perivascular spaces. These marker of small vessel diseases are associated with increased incidence of stroke, dementia, and cognitive decline. Understanding the genetic risk factors for stroke and cerebral small vessel disease, has the potential for identifying novel pathways leading to new therapy and better understanding of the disease pathophysiology.

In order to identify new genetic risk factors for stroke and its subtypes we have re-analyzed existing large scale genome wide association study data using new statistical methods that use multivariate analysis approach like the one implemented in multi-trait analysis of GWAS (MTAG). We use MTAG to analyze the stroke GWAS data of MEGASTROKE consortia and we were able to identify four novel loci for stroke. We used an independent data set obtained through UK Biobank to validate these novel loci and two of them were replicated. This indicates that use of multivariate analysis can aid in identification of novel loci for stroke.

To identify novel genetic risk factors for white matter hyperintensities and microbleeds, two markers of cerebral small vessel disease, we used the data on subjects from UK Biobank with MRI. White matter hyperintensities volumes values were available from preexisting analysis but microbleeds were estimated using a published 3D CNN algorithm but adapted for UK Biobank MRI data. Genome wide association analysis revealed at least 10 new loci for white matter hyperintensities volumes and two novel loci for burden of microbleeds. These novel loci for stroke and cerebral small vessel diseases have opened new avenues for investigations into the pathophysiology of the disease that affect millions of people worldwide especially those from south Asian countries like India where there is a higher burden of vascular risk factors.

Dr. Bratati Kahali

Project title : Decoding genetic basis of metabolic disorders and its shared genetic etiology with dementia in Indian population

Funding: Ramalingaswami Fellowship

Project personnel: Abhishek Panda

Polygenic and complex human disease like, dyslipidemia, type 2 diabetes (T2D), cardiovascular disease, fatty liver disease and Alzheimer's dementia, are caused by genetic variations in more than one gene as well as environmental contributions, and obesity is a precursor to these complex diseases in the general population. General obesity measured by body mass index (BMI) and central obesity often co-occurs with or predisposes individuals to other complex human disease like, type 2 diabetes (T2D), cardiovascular disease, non-alcoholic fatty liver disease (NAFLD) and Alzheimer's dementia (AD). There is considerable overlap of genetic loci for these metabolic and neurodegenerative conditions, thus suggesting about their shared genetic underpinnings and partly shared biological pathways. However, epidemiological studies cannot provide much information on causality of adiposity to the related metabolic and neurodegenerative conditions. Large scale comprehensive genetic analyses for such complex disorders are lacking in India.

The aim of this project is to investigate the genetic basis of the causal relationship of adiposity (general obesity and central obesity) to T2D, NAFLD, AD using Mendelian Randomization (MR).

In order for the genetic analysis to progress in Indian samples, currently a pipeline is being developed for accurate and efficient genotype imputation for Indian samples. The genotype data of >500 Indian samples from Affymetrix scanner and PMRA arrays have been analyzed. Haplotype merging of international cosmopolitan reference datasets as well as publicly available South Asian datasets with Indian WGS data has been done to create an intermediate and accurate imputation panel. In this experiment, a modified imputation reference panel was built by merging 1000 Genomes data along with Indian samples joint calling data at CBR, IISc. Increased accuracy of imputation is observed for Indian GWAS samples using this merged panel, although not significantly more. However, it is important to note that this is an evolving exercise and the merged panel with more data from Indian WGS is capable of showing reliable results regarding marked increase in imputation accuracy. Additionally, genome wide association studies is being conducted for phenotypes BMI, and T2D for array wide data for these Indian samples, which will form the basic summary stats for the MR work downstream.

Project title: Epistasis analysis of APOE in understanding the genetic architecture of Alzheimer's disease: A computational genetics approach

Funding: SERB Early Career Research Award

Project personnel: Sheldon D'Silva

Large scale meta-analysis of genome wide association studies (GWAS) and family-based studies have implicated several genomic loci to be strongly associated with Alzheimer's disease (AD). This includes apolipoprotein E (*APOE*), the biggest genetic risk factor for AD. The derived combinations of *APOE* genetic polymorphisms rs7412, rs429358 give rise to the ε2, ε3, ε4 isoforms of *APOE*, the last one being of greatest risk when present in homozygous form in an individual. However, the genetic loci fail to account for substantial phenotypic variation for Alzheimer's disease. In addition to rare alleles driving the major genetic component of the disease, one of the causes for this unexplained variance, commonly known as the missing heritability for complex diseases, can be attributed to gene-gene or gene by environment interactions.

In this project, the aim is to decipher how epistasis defines the genetic architecture of AD by investigating pairwise SNP interactions implicated in AD.

Different regression based, machine learning based, information theory based, multidimensionality reduction based, and Bayesian theory- based approaches for gene-gene interactions have been tested with publicly available datasets. The actual implementation of these programs required interventions and modifications in source code. Additionally, in house programs are currently being developed to scale currently available programs for higher order epistatic interactions for >5000 single nucleotide variations, while adjusting for covariates and the same is to be implemented in continuous as well as binary phenotypes.

Ultimately, a machine learning algorithm that reduces the combinations of genotypes between 2 or more loci as an array of high risk 1 and low risk 0 values using the case/control ratio for each combination have been finalized as the best choice. The models are trained on 9 parts of the parsed genotype matrix and tested on the final 10^{th} part. This is where they are evaluated for their predictive accuracy and confidence score. This program has the crucial features: the ability to input the phenotype of interest as quantitative values, parsing the heterozygous configurations in the genotype matrix, model-free: provides for better detection when mode of inheritance is unknown, nonparametric: number of interaction terms does not grow exponentially with increase in variables, the ability to compute orders of interaction beyond 2, provide for covariate adjustment which increases the accuracy for risk assessment.

To overcome computational limitation, runtime scripts were developed that enable the search space to be reduced. This was achieved by recursively chunking the genotype matrix and eliminating the SNP least probable to interact, resulting in a pruning of 10 SNPs per recursion. By employing the developed runtime optimizations, significant reduction in the execution time for

the large dataset to approximately 5 hours for up to 5th order interaction was achieved, which was earlier entirely unable to process in existing computation configurations. This protocol will be further deployed to parse larger datasets in order to define the epistasis that governs interactions with APOE for AD.

Dr. Smitha Karunakaran

Project Title: Role of Locus Coeruleus in maintaining cognitive function in normal and pathological ageing, such as dementia

Funding: CBR core fund

Project personnel: Abhijit Shankaran

The overarching goal of our laboratory is to understand the functional importance of hippocampal projecting neurons/systems specially locus coeruleus, and how they transform hippocampal network activity and modulate behavior in APP/PS1 mouse model of Alzheimer's disease (AD). Behavioral impairments during the early stages of AD is paramount and is gaining momentum. In order to understand the nature and dynamics of these early behavioral deficits, we systematically studied the temporal course of behavioral expression in 2-month-old APP/PS1 mice using hippocampus dependent and independent behavior paradigms. Mapping the time course of fear expression using the hippocampus dependent contextual fear conditioning paradigm indicated a time dependent decline in the strength of fear memory after fear learning acquisition. We further observed that APP/PS1 had an early, local noradrenergic signaling dependent time window in the hippocampus which is imperative for long-term fear memory persistence. This further indicated that, proper encoding of fear memory is dependent on early noradrenergic signaling which was compromised in 2-month-old APP/PS1 mice. Deficits at the earlier ages tend to be subtler but usually progress to marked impairments as age progresses. Therefore, subtle intermediate behavioral readouts can potentially be harbingers to late onset disease conditions such as AD. Our longitudinal analysis of individual 2-month-old APP/PS1 mice following Morris water maze, a hippocampus dependent behavior paradigm further revealed distinct altered search habits, which led to abrupt learning transitions, and topographical disorientation unlike their wildtype counterparts. Other than relying on conventional behavioral readouts, we further implemented an alternative way of analysis by focusing on the unsuccessful trials during water maze learning to emerge at the real nature of cognitive deficits. Our results suggest that, studies using AD models require a systematic revaluation of existing behavioral assessment methodologies, in the light of our current understanding of AD progression and pathogenesis. Numerous neuropsychological studies have reported impairments in semantic memory to occur relatively earlier during the course of AD (PMID: 23972157, PMID: 7617154, PMID: 11459744). Since the diagnostic criteria for mild cognitive impairment due to AD still

assign a central role for the more constant and obvious episodic memory loss (PMID: 27012484, PMID: 21514249), we still do not know the impact of early semantic memory distortions during asymptomatic stages of AD. Using a short-term, and a long-term object-based priming paradigm, we show for the first time that it is possible to detect early semantic - like impairments prior to episodic memory deficits in APP/PS1 mouse model of AD. A key feature of this method is that, it can activate its presence during target memory encoding in APP/PS1 mouse model, and thus negate learning before amyloidosis onset. We also demonstrate that noradrenergic receptor agonist delivered at low doses, can therapeutically reverse these deficits. Our data highlight that **semantic-like distortions occur early in APP/PS1 mouse model of AD, and object-based priming, a proxy for semantics can be used as a tool to detect these deficits. We are currently probing the molecular and cellular** mechanisms underlying these behavioral deficits.

Dr. Vivek Tiwari

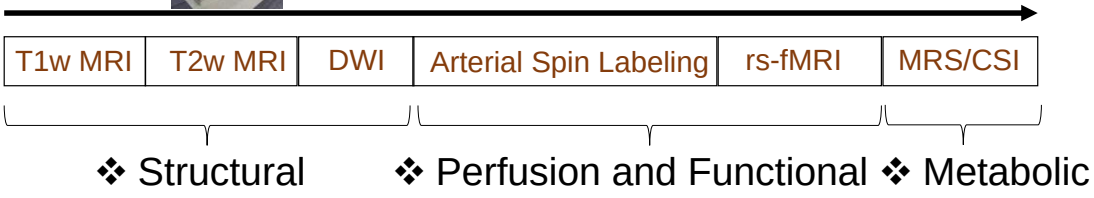
Project title: Structural, Vascular, Metabolic investigations in TATA Longitudinal Study of Aging (TLSA) and Srinivaspura Aging, Neuro Senescence and COGnition (SANSCOG) cohorts at 3T

Funding: CBR Core Fund

Overall aim of my research is *in vivo* identification of Vascular, Structural and Metabolic alterations in brain that can serve as a noninvasive diagnostic and prognostic marker of aging and dementia (mainly vascular dementia). We are investigating how does cerebral vascular health (small and large blood vessels health) remodel the brain structure and function, and translate to the clinical manifestations of dementia? We are employing advanced neuroimaging method at the 3 Tesla MRI scanner to study vascular pathologies such as white matter hyperintensities (WMHs), perivascular spaces, microbleeds, cerebral blood flow (CBF) and their impact on brain structure and function.

We are recruiting subjects of the age above 45 from the ongoing TATA longitudinal study of aging (TLSA) and Srinivaspura Aging, Neuro Senescence and COGnition (SANSCOG) studies for the brain MRI measurements at the JN TATA MRI Centre, IISc, Bangalore. MRI measurements are being performed at baseline and yearly follow-ups closer to the clinical and cognitive visits. Advanced neuroimaging measurements including Structural MRI, perfusion based Cerebral Blood

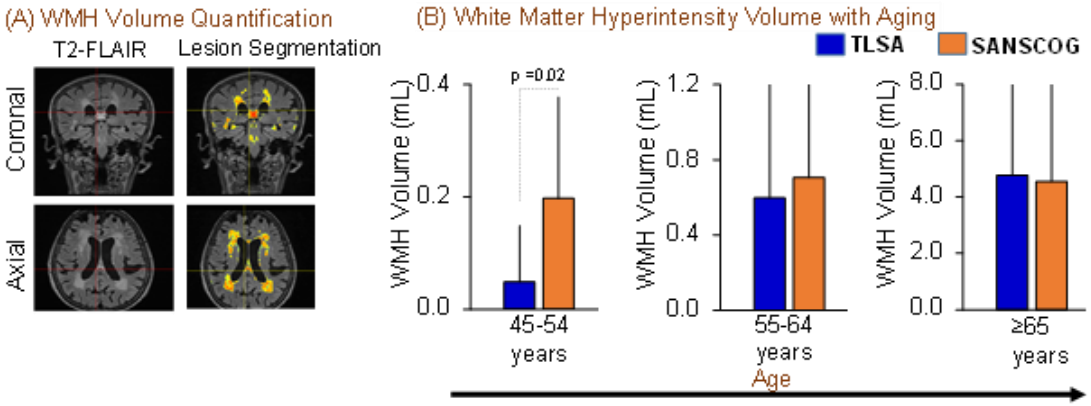
Figure 1



Flow measurements, functional-MRI (fMRI), and metabolic measurements are being performed in each subject spanning over 60 minutes (Fig.1).

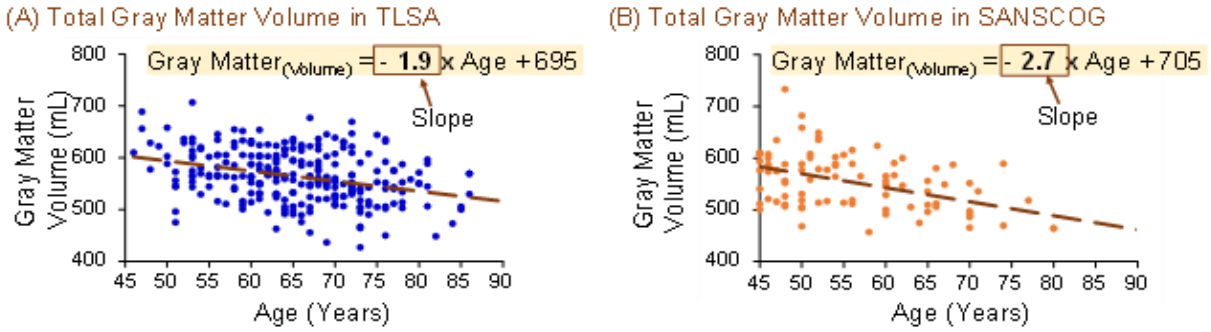
We have extensively analyzed the MRI data from TLSA (N=284) and SANSCOG (N=91) cohorts for vascular pathologies and anatomic volumes. MRI analysis shows that majority of subjects in TLSA and SANSCOG showed small vessel disorder pathology in form of White matter hyperintensity (WMHs) on T2-FLAIR images. Brain segmentation and quantification of WMH pathology showed high prevalence and load of WMH in the SANSCOG cohorts at the early age of 45-54 years compared to the TLSA cohorts (Fig.2).

Figure2



We further segmented the whole brain images for evaluating the structural changes with aging in TLSA and SANSCOG cohorts. Brain anatomic volume analysis showed that gray matter volume (GM) loss with age was significantly faster in SANSCOG cohort compared to TLSA cohort (Fig.3 A *vs* B). In contrast, reduction of hippocampus volume was faster in TLSA compared to SANSCOG cohorts.

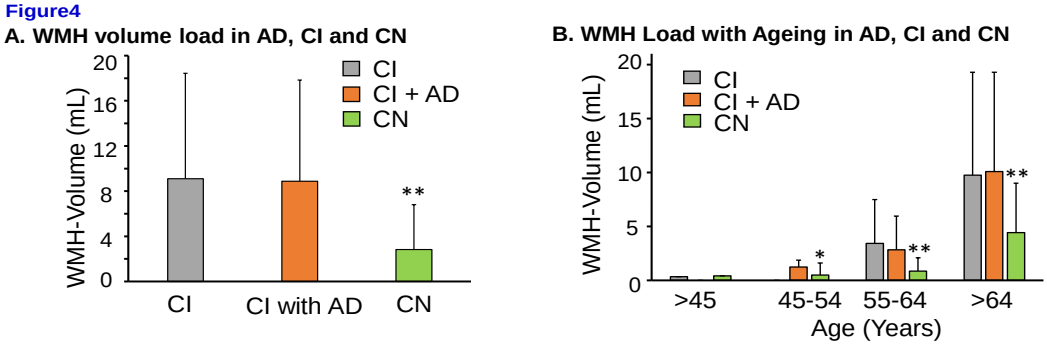
Figure3



At the given number of the subjects currently we have in the TLSA and SANSCOG cohorts, it is apparent that rural population (SANSCOG) has early onset of brain vascular pathology seen as WMHs. Distinct kinetics of structural atrophy and ventricular hypertrophy between urban cohort and rural cohort may arise due to distinct genetic or environmental predispositions leading into differential vascular insult. We are extending our MRI measurements across large number of subjects in the TLSA and SANSCOG cohorts to attain higher sensitivity and confidence of unravelling the effect of vascular pathologies on brain health.

In addition to MRI investigations in the TLSA and SANSCOG cohorts, my group is also studying the vascular pathologies and its impact using the data from studies in the US and European countries such as National Alzheimer's Coordinating Center (NACC). WMH volume was higher in subjects with cognitive impairment (CI and CI+AD) compared to age matched cognitively normal (CN) subjects (Fig.4). However, WMH pathology alone could not distinguish cognitively impaired individuals with that from cognitively impaired with AD. Using the MRI findings together with cognitive and genetic data from NACC, we are developing a multivariate model to delineate subjects with impaired cognitive performance (CI) from that of cognitively impaired subjects with AD (CI+AD).

Figure4



We are further extending the MRI measurements of WMH volume, anatomical structures together with genetic correlates and other risk factors to develop a model for achieving sensitivity to distinguish cognitively impaired subjects with AD from cognitive impairments without AD and age- matched normal aging subjects.

Dr. SN Suresh

Project title: Investigating regulation of mitochondrial-mediated late endosome fission: Implications in Alzheimer's disease

Neurodegenerative diseases (ND) such as Alzheimer's (AD) and Parkinson's (PD) are debilitating with no available therapeutic intervention to alter the course of disease progression. An emerging recent concept is that cellular homeostasis is also maintained by close interactions among organelles at a specific dynamic interface called membrane contact sites (MCS) to carry out functions of cellular pathways and relay intracellular signaling. Among membrane bound organelles, mitochondria and lysosomes are crucial for their functioning as they serve as central nodal players of anabolic and catabolic pathways of neurons. Mitochondria are dynamic that undergoes fission-fusion enabling the neurons to adapt to plethora of scenarios that are aided by cross-talk between signaling pathways and metabolism. Lysosomes are essential for neurons as they help in clearing the excess contents by its lysosomal proteases and lipases. Recent study reports an occurrence of mitochondrial-lysosome (M-L) contact sites that gets regulated by Rab7 GTPase. However, the function of this contact site remains enigmatic. We aim to understand the molecular mechanisms that govern the mitochondria- lysosome contacts in health and disease. We will employ cutting-edge live cell microscopic techniques; CRISPR/Cas9 mediated genetic manipulation, molecular and cell biological methods to address these intriguing questions.

Key findings

1) Superresolution confocal live cell imaging reveals a potential novel role of mitochondria in regulating fission of Rab7 positive compartments. Towards this, we observed that mitochondria enwrap the Rab7 positive compartments and facilitating its fission by acting as a diffusion barrier.
2) Next, we characterized the molecular players involved in mitochondrial mediated Rab7 positive compartment fission. First, the Mfn2 as well as Fis1 is recruited to contact sites of mitochondria-Rab7 positive compartments that is followed by recruitment of phosphotidyl inositol-4-kinase B (PI4KB) to contribute phosphotidyl inositol-4-phosphate (PI4P). Biochemical assays indicate that Mfn2, Fis1 as well as PI4KB physically interact with Rab7.

3) We observed the localization of SORL1 (endocytic cargo receptor) at the contact sites of mitochondria and Rab7 positive compartments. SORL1 regulates the dynamics of Rab7 positive compartment fission by interacting with FYCO1. SORL1 is one of the risk genes of AD and its mutation could lead to manifestation of early as well as late onset of AD. However, its native function during normal conditions is not clear yet. Towards this, we unraveled the novel role of SORL1 in regulating mitochondrial mediated fission of Rab7 positive compartments. Currently, we are investigating the role of patient mutants of SORL1 in affecting fission of Rab7 positive compartments and delivery of lysosomal enzymes.

2. LECTURES / TALKS / PRESENTATIONS

- Dr. Vijayalakshmi Ravindranath gave the Plenary lecture during the 37th Annual Conference of Indian Academy of Neurosciences from 19th -21st November 2019. She gave a lecture on " Understanding Dementia and the challenges for India"
- Dr. Vijayalakshmi Ravindranath was an invited speaker for the Vijyoshi - 2019 National Science Camp held from 6th -8th December 2019 at IISc, Bengaluru. She gave a lecture on "Human Brain: Complexity behind simplicity"
- Dr. Vijayalakshmi Ravindranath as an invited speaker on the RGCB foundation day held on 18th November 2019. She gave a talk on " Life and the Brain"
- Dr. Vijayalakshmi Ravindranath was an invited speaker for the CLRI-Science Day Lecture, February 28, 2020. She gave a lecture on "Ageing and Dementia: mechanisms to intervention
- Dr. Ganesh Chauhan presented at the 3rd International Society of Gene and Cell Therapy (ISGCT) conference, 10-12th November, 2019 at Bangalore, India and presented his work "New Biological Insights from Large Scale Genomics Data and Application in Therapeutic Interventions".
- Dr. Ganesh Chauhan presented at the Conference on Drug Design & Discovery Technologies, CDDT - 2019. Jointly Organized by Pharmacological Modelling & Simulation Centre (PMSC), Ramaiah University of Applied Sciences (RUAS), Bangalore, India with Royal Society of Chemistry (RSC), UK. 21st – 22nd Nov 2019. Dr Ganesh presented his work titled as "Using large scale genomics to identify drug targets and inform clinical trial study design
- Dr. Bratati Kahali was invited to give a lecture on (virtualize presentation) "Whole Genome Sequencing in Indian Population: An Analytical Perspective" at the NSDDB-2019 (2nd National Symposium on Database Development and Biocuration) at University of Delhi, Delhi, in December 17-18, 2019.
- Dr. Bratati Kahali was invited to give workshop presentation and delivered a lecture for BSSE, Annual Research Symposium on "Theoretical and Computational Biology- Large scale human

whole genome data analysis to understand disease susceptibilities: practical guide" at IISc on 23rd of January, 2020.

- Dr. Vivek Tiwari was invited as a speaker at the 'SPARC MHRD conference on Advanced Neuroimaging Initiative', IIT Kanpur, Jan 30 - Feb 2, 2020.
- Dr. Vivek Tiwari was invited as a speaker at the 26th National Magnetic Resonance Society Meeting and International Conference on NMR from Molecules to Human Behavior and Beyond. Saurashtra University, Rajkot, Feb 18- Feb 21, 2020

3. EVENTS

3.1 International Scientific Advisory Board – Meeting

The meeting of the International Advisory Board of CBR was held on 17th May 2019 at Boston. The Advisory Board Committee meeting was preceded with a meeting which was attended by the members of the Advisory Committee, representative of international funding agencies, Tata Trust and other influential faculty members. The meeting was a great success and the activities of CBR have been well appreciated. The funding agencies have shown interest in collaborating and funding the activities. It is proposed to keep up this momentum in the activities of CBR.

Prof. Anurag Kumar, Director, IISc and Mr. Kris Gopalakrishnan also attended the meeting.

3.2 Scientific Advisory Committee – Meeting

The Scientific Advisory Committee meets biannually and was held on 30th July 2019 and 6th January 2020. The committee reviewed the on-going projects and gave valuable suggestions. New projects proposals were also considered during these meetings.

3.3 CBR Lecture

The current focus of CBR is on neurodegenerative disorders involving researchers from the field of epidemiology, clinicians, genetics, MRI, computational bioinformatics and molecular biology. Many of the fields mentioned above are in their nascent state in the Indian research arena. Hence, CBR has made an effort to bring experts from these diverse fields and give lectures in Indian Institute of Science to create awareness about integrative research in the field of neurodegenerative, These lectures are well published and researchers from different background within IISc and neighboring institutions and attend these lectures series often

called as the “CBR popular lectures series”. During the year the following lectures have been arranged under this;

1) "Role of MR imaging (MRI) and in vivo MR Spectroscopy (MRS) in Clinical Medicine"

Speaker: Prof. N. R. Jagannathan Department of NMR and MRI Facility All India Institute of Medical Sciences, New Delhi held on 3rd June 2019

2) "Big data for social value creation"

Speaker: Prof. Pulak Ghosh IIMB Chair Professor of Excellence, Faculty of Decision Sciences & Centre for Public Policy (Secondary Member) Indian Institute of Management, Bangalore held on 4th July 2019.

3) “Healthcare Innovation: Idea to Clinical Product”

Speaker: Dr Chetan Mittal Chief Medical Officer, DocOnline Health India Private Limited Bangalore held on 30th August 2019

4) “How can we enhance Healthcare Role of Research & Innovation”

Speaker: Gullapalli N Rao, Chair, L V Prasad Eye Institute, Hyderabad held on 22nd November 2019

5) "Evolution in small and isolated tiger populations”

Speaker: Prof Uma Ramakrishnan Senior Fellow, Wellcome Trust DBT and an Associate Professor at NCBS held on 9th December 2019

6) "Phenomenal resemblance in the degradation mechanism of biological macromolecules”

Speaker: Dr. Sudip Kundu Professor at the Department of Biophysics, Molecular Biology and Bioinformatics of University of Calcutta held on 14th February 2020

7) “Lecture on OCT “

Speaker: Dr. G Chandra Sekhar, Vice Chair L V Prasad Eye Institute, Hyderabad, held on 24th February 2020

4. ACADEMIC COLLABORATION

4.1. Indian Institute of Science:

IISc has approved joint academic and research programmes as per the following;

- Up to two Ph. D students would be allowed to carry out collaborative research at CBR in areas aligned with the mandate and vision of CBR. But the students will be admitted to the Institute and be under the supervision of the Institute faculty. A faculty member from CBR would be the co-supervisor, similar to the ERP Program.
- The scholarship for the students would be provided by the CBR and students may be encouraged to stay outside the institute campus.
- CBR faculty may get involved in offering courses at IISc either individually or jointly with IISc faculty.

As per this, two students have joined during the academic year 2019

4.2 Affiliation of CBR to Manipal Academy of Higher Education:

In order to admit more students in the relevant field of research at CBR, it is necessary that CBR faculty should be able to take students independently, as it may be difficult to find a faculty in IISc who has interest in the research areas of CBR to function as research supervisor. Moreover a few clinicians have also shown in interest in joining research program at CBR and they may not be able to get admission directly to IISc.

In order to facilitate this CBR has approached MAHE for affiliation for the Ph.D programme. The application was approved and four students have enrolled in this programme during the year 2019.

5. PUBLICATIONS

1. Kommaddi RP, Tomar DS, Karunakaran S, Bapat D, Nanguneri S, Ray A, Schneider B, Nair D, and **Ravindranath V**: Glutaredoxin1 ameliorates Aβ mediated oxidation of F-actin and reverses cognitive deficits in an Alzheimer's disease mouse model. **Antioxid Redox Signal. 2019;** 31(18):1321-1338 .
2. Verma A, **Ravindranath V.:** Cav1.3 L-Type Calcium Channels Increase the Vulnerability of Substantia Nigra Dopaminergic Neurons in MPTP Mouse Model of Parkinson's Disease. **Front Aging Neurosci.** 2020 Jan 17; 11:382. doi: 10.3389/fnagi.2019.00382.
3. Verma A , Ray A, Bapat D, Diwakar L, Kommaddi RP, Schneider B, Hirsch EC, Ravindranath V.: Glutaredoxin 1 Downregulation in the Substantia Nigra Leads to Dopaminergic Degeneration in Mice. **Movement Disorder**, **https://doi.org/10.1002/mds.28190.**
4. Kivipelto M et al, World-Wide FINGERS Network: A global approach to risk reduction and prevention of dementia. Alzheimer's and Dementia https://doi.org/10.1002/alz.12123
5. Sandeep Kumar Barodia, Krishnan Prabhakaran, **Smitha Karunakaran**, Vikas Mishra and Tapias. Editorial: Mitochondria and Endoplasmic Reticulum Dysfunction in Parkinson's Disease. **Front Neurosci**. 2019 Nov 8 (13):1171.
6. **Reddy Peera Kommaddi**, Deepika Singh Tomar, **Smitha Karunakaran**, Deepti Bapat, Siddharth Nanguneri, Ajit Ray, Bernard L Schneider, Deepak Nair, **Vijayalakshmi Ravindranath**. Glutaredoxin1 Diminishes Amyloid Beta-Mediated Oxidation of F-Actin and Reverses Cognitive Deficits in an Alzheimer's Disease Mouse Model. **Antioxid Redox Signal**. 2019 Dec 20;31(18):1321-1338.
7. Nucleolus: a protein quality control compartment. Pavani and **SN Suresh**#. Trends in Biochemical Sciences. 2019; 44 (12), 993-995. #Corresponding author.
8. Neuron–Astrocyte Liaison to Maintain Lipid Metabolism of Brain. S Mukherjee, **SN Suresh**#. Trends in Endocrinology & Metabolism. 2019; 30(9), 573-575. #Corresponding author.
9. Endoplasmic reticulum mitochondria contacts modulate apoptosis of renal cells and its implications in diabetic neuropathy. **SN Suresh**#. EBioMedicine. 2019; Jun;44:24-25. #Corresponding author.
10. A small molecule autophagy inducer exerts cytoprotection against α-synuclein toxicity. **SN Suresh**, R Manjithaya. European journal of pharmacology. 2019; 862, 172635.
11. Small molecule modulator of aggrephagy regulates neuroinflammation to curb pathogenesis of neurodegeneration. **SN Suresh**, Janhavi Pandurangi, Ravi Murumalla, DJ Vidyadhara, Lakshmi Garimella, Achyuth Acharya, Shashank Rai, Abhik Paul, Haorei Yarreiphang, Malini

S Pillai, Mridhula Giridharan, James P Clement, Phalguni Anand Alladi, Taslimarif Saiyed, Ravi Manjithaya. EBioMedicine. 2019; 50, 260-273. Cover page article.

12. Pharmacological tools to study autophagy. **SN Suresh**, A Chakravorty, Lakshmi G, R Manjithaya. Journal of Molecular Biology. 2020; 432(8), 2822-2842.
13. Machine learning-based cognitive impairment classification with optimal combination of neuropsychological tests. Gupta A, **Kahali B**. Alzheimers Dement (N Y). 2020 Jul 19;6(1):e12049.
14. Protein-coding variants implicate novel genes related to lipid homeostasis contributing to body fat distribution. Justice AE, Karaderi T, Highland HM, Young KL, Graff M, Lu Y, …., **Bratati Kahali**,…., North KE, Lindgren CM. Nature Genetics 51(3), 452-469, 2019.
15. Zinia M; Gaonkar SK; Kumar M; Saini J; **Tiwari V**; Srivastava C; Atreya H. Influence of Oxidation Degree of Graphene Oxide on Its Nuclear Relaxivity and Contrast in MRI (2020) ACS Omega (Accepted)
16. **Tiwari V**, Daoud EV, Hatanpaa KJ, Gao A, Zhang S, An Z, Ganji SK, Raisanen JM, Lewis CM, Askari P, Baxter J, Levy M, Dimitrov I, Thomas BP, Pinho MC, Madden CJ, Pan E, Patel TR, DeBerardinis RJ, Sherry DA, Mickey BE, Malloy CR, Maher EA, Choi C. Glycine by MR spectroscopy is an imaging biomarker of glioma aggressiveness. Neuro-Oncology (2020)
17. **Tiwari V**, Mashimo T, An Z, Vemireddy V, Piccirillo S, Askari P, Hulsey KM, Zhang S, de Graaf RA, Patel TR, Pan E, Mickey BE, Maher EA, Bachoo RM, and Choi C. In Vivo detection of 2-Hydroxyglutarate in IDH mutant Mouse and human brain tumor. Magnetic Resonance in Medicine (2020)

6. BUILDING

A new building for CBR is under construction in the land identified for CBR at IISc Campus. This will have a state of art Brain Research Laboratory and Clinical research facilities. The intention is to develop this project as a unique world class facility and one of its kind research facility. The built-up area is 1,10,000 sq.ft in a configuration consisting of basement + ground + 5 stories totaling 7 stories. The facility shall cater to 100 professionals and have a minimum of LEED Gold rating. It is envisioned to position the brain and DNA bank in the basement. The ground floor of the facility will be used for research work related to human subjects including clinical, cognitive evaluation, EEG etc. It will also have a cafeteria, lounge for the volunteers who have agreed to participate in the Research and Administrative Office. Wet labs for genetics and basic biology, informatics, cognitive science and related research will be provided on the 1st, 3rd, 4th and 5th floors. The 2nd floor will have the services and an auditorium. It will be centrally air-conditioned building. The estimated cost of the building is around 45 Crores.

The building is funded by Pratiksha Trust.

The Contract has been awarded and Bhoomi Pooja was conducted on 13th August 2018.The work is progressing well, and it is expected to complete by December 2020.

The Construction activities are monitored by a committee consisting of following;

- Prof. H. P. Khincha — Chairman
- Prof. Vijayalakshmi Ravindranath, Director, CBR — Member
- Prof. A. Sridharan — Member
- Prof. B.R. Srinivasamurthy — Member
- Prof. B.K. Raghuprasad — Member
- Prof. G. Rangarajan — Member
- Prof. Y. Narahari, — Member
- Mr. R. Mohan Das, Special Officer, CBR — Member

7. FINANCE

The total receipts for the year 2019-20 was Rs. 4271.46 Lakhs and the payments for various activities of the Centre was Rs. 2774.50 Lakhs.

The details of Receipts and Payments for the year 2019-2020 are as follows.

Sl.No.	Particulars	Receipts (In Lakhs)	Payments (In Lakhs)
1	Donations from Pratiksha Trust towards Activities Account	1652.91	1527.24
2	Other Receipts	106.4	0
3	Donations from Pratiksha Trust towards Construction of New Building	1745.35	1147.52
4	Funds from External Agencies	766.8	99.74
Total		4271.46	2774.5

Funds Received from External Agencies during 2019-20					
Description	Funding Agency	Total Amount Sanctioned (In lakhs)	Funds Received during 2019-20		Total Funds Received (In lakhs)
			Existing Projects (In lakhs)	New Projects (In lakhs)	
DBT GenomeIndia Project - Prof Vijayalakshmi Ravindranath	Department of Biotechnology	5652	-	589.5	589.5
DST Inspire Program - Dr Suresh S N	Department of Science & Technology	112.4	-	22	22
Funds from IISc - NBRC - Prof Vijayalakshmi Ravindranath				69.94	69.94
Ramalingaswami Fellowship - Dr Bratati Kahali	Department of Biotechnology	32.5	3.21	-	3.21
Ramalingaswami Fellowship - Dr Ganesh Chauhan	Department of Biotechnology	32.5	12.5	-	12.5
SERB Project - Dr Bratati Kahali	Science & Engineering Research Board	37.44	-	22.35	22.35
SPARC Project - Prof Vijayalakshmi Ravindranath	Sun Pharma Advanced Research Company Limited	53.4	46.9	-	46.9
SPM Fellowship - Contingency Grant	Council of Scientific & Industrial Research	3.2	-	0.4	0.4
Total		5923.44	62.61	704.19	766.8

Funds have been sanctioned from Fidelity Bermuda Foundation	251.25

8. GOVERNANCE STRUCTURE & PEOPLE AT CBR

8.1 Society

Centre for Brain Research (CBR) is a registered society under the Karnataka Societies Act 1960. The Society has very eminent persons from the different fields, as its members. The current members of the Society are following

Dr. Palle Rama Rao
Chairman, Governing Council,
IISc (Ex- Officio)

Prof. Anurag Kumar
Director
Indian Institute of Science (Ex- Officio)

Chief Secretary,
Govt of Karnataka (Ex- Officio)

Additional Chief Secretary
Govt of Karnataka (Ex- Officio)

Principal Secretary (Finance)
Govt of Karnataka (Ex- Officio)

Secretary to Govt of Karnataka
Dept of IT, BT & Science & Technology
Govt Secretariat (Ex- Officio)

Dr. Ramesh Babu
No.17 Nirvana, Trans Indus, Tataguni
Bangalore

Dr. Girija Ramesh Babu
No.17 Nirvana, Trans Indus, Tataguni
Bangalore

Dr. B N Gangadhar, Director
NIMHANS, Bangalore

Mr. Kris Gopalakrishnan
#855,13th Main,4th A Cross
III Block Koramangala
Bangalore

Smt. Sudha Gopalakrishnan
#855,13th Main,4th A Cross
III Block Koramangala
Bangalore

Dr. Krishnaswamy Kasturirangan
Chairman, Governing Council
Raman Research Institute
Bangalore

Prof. H P Khincha
No.11,4th Main Road, Chamrajpet
Bangalore

Prof. Paturu Kondaiah
Dept of MRDG, IISc

Prof. N Balakrishnan,
Dept of SERC, IISc

Shri. Dinesh Krishnaswamy
No.467,19th Main,36th Cross
4th T Block, Jayanagar
Bangalore

Dr. Satyajit Mayor
Director
NCBS Bangalore

Smt. Sudha Murthy
No.575, Amoghavarsha, 21st Main,35th Cross, 4th T Block, Jayanagar
Bangalore

Prof. Vijayalakshmi Ravindranath
Director, CBR

Prof. Y Narahari
Dept of Computer Science and Automation,IISc

Shri S D Shibulal
No.383,42nd Cross,9th Main,5th Block, Jayanagar, Bangalore

Prof. Govindarajan Padmanabhan
Emeritus Professor
Dept of Biochemistry
IISc

Dr. M S Valiathan
National Research Professor
Manipal University, Madhav Nagar
Manipal

Shri. S V Ranganath
No.25,8th Cross,2nd Block, Jayanagar
Bangalore

Shri. M N R Venkatachaliah
Former Chief Justice of India

Prof. M R S Rao
JNCASR, Bangalore

Prof. Umesh Varshney
Dept of Microbiology and Cell Biology, IISc

Prof. Govindan Rangarajan
Dept of Mathematics, IISc

Prof. D N Rao
Dept of Biochemistry, IISc

8.2 Governing Board

The affairs of the CBR are administrated, directed and controlled, by the Governing Board. The Governing Board of the Society shall consist of the following Members;

i) Chairman, who shall be ex-officio Director, IISc
ii) Four Members of the Society as may be nominated by Pratiksha Trust.
iii) Five Members of the Society as may be nominated by the Council of IISc
iv) Member Secretary shall be the Director of Centre for Brain Research

The current composition of the Governing Board is as follows;

Prof. Anurag Kumar, Chairman
Director
IISc (Ex Officio)

Mrs. Sudha Gopalakrishnan
#855,13th Main,4th A Cross
III Block Koramangala
Bangalore

Shri. Kris Gopalakrishnan
#855,13th Main,4th A Cross
III Block Koramangala
Bangalore

Prof. H.P. Khincha
No.11,4th Main Road, Chamrajpet
Bangalore

Shri. Dinesh Krishnaswamy
No.467,19th Main,36th Cross
4th T Block, Jayanagar
Bangalore

Shri. S D Shibulal
No.383,42nd Cross,9th Main,5thBlock,
Jayanagar, Bangalore

Prof. Y. Narahari
Dept of Computer Science and
Automation, IISc

Prof. G Rangarajan
Dept of Mathematics, IISc

Prof. D N Rao
Dept of Biochemistry, IISc

Prof. Umesh Varshney
Dept of Microbiology and Cell Biology,
IISc

Prof. Vijayalakshmi Ravindranath
Director, CBR (Member Secretary)

8.3 Finance Committee

CBR has a Finance Committee which meets every three months to review the financial positions of the Centre and make recommendations to the Governing Board from time to time. Finance Committee consists of the following;

Prof. Anurag Kumar, Chairman
Director
IISc (Ex Officio)

Prof. Vijayalakshmi Ravindranath
Director, CBR

Prof. Jayanth M Modak
Deputy Director, IISc

Prof. G Rangarajan
Dept Of Mathematics, IISc

Mr. K C Ganesh
Pratiksha Trust

Mr. R Mohan Das
Secretary, Special Officer, CBR

8.4 Ethics Committee

An Ethics Committee has been constituted by the Governing Board, as mandated by the National Ethical Guidelines for Biomedical and Health Research involving human participants, Indian Council of Medical Research (ICMR) Govt. of India.

Dr. B. A. Chandramouli, Chairman
Neurosurgeon
Aster Hospital
Bangalore

Dr. Kiran Khanapure
M S Ramaiah hospital, New BEL Rd,
M S Ramaiah Nagar, Mathikere,
Bengaluru- 560054

Mr. Arvind Moorchung
King & Partridge advocates,
48, Lavelle Rd,
Bengaluru- 560001

Mr. Alaganandan Balaraman
CGN Global,
562/640, 2nd floor, above Kalyani Motors, Bannerghatta Main Rd,
Bilekahalli, Bengaluru- 560076

Prof. Anitha Kurup
National Institute of Advanced Studies,
Indian Institute of Science campus,
C V Raman Avenue
Bengaluru- 560012

Prof. Arun Kumar
Department of Molecular Reproduction, Development and Genetics (MRDG),
Indian Institute of Science campus,
C V Raman Avenue, Bengaluru- 560012

Prof. Sundar Sarukkai
National Institute of Advanced Studies,
Indian Institute of Science campus,
C V Raman Avenue
Bengaluru- 560012

8.5 International Scientific Advisory Board

An International Advisory Board consisting of International as well as national experts shall be constituted by the Governing Board. The Board meets biannually.International Advisory Board consisting of the following;

Prof. Steven E Hyman,
Chairman

Prof. John Morris,
Washington University

Prof. Maria Corrillo,
CSO, AA

Prof. Stanley Fahn,
Columbia

Prof. Sudha Seshadri,
San Antonie

Prof. Carla Shatz,
Stanford

Prof. Mary Ganguly,
Pittsburg

Prof. Srinath Reddy,
PHFI, New Delhi

Prof. B N Gangadhar,
NIMHANS, Bangalore

Prof. Bart D Strooper,
Director, UK Dementia Research Institute, UCL Queen Square Institute of Neurology, UK

Dr. Stacie Weninger,
President of FBRI, USA

Prof. Vasant Honavar,
Professor and Edward Frymoyer Chair of Information Sciences and Technology, Penn State University, USA

Prof. Vijayalakshmi Ravindranath,
Director, CBR

8.6 Scientific Advisory Committee

The Scientific Advisory Committee (SAC) for the Centre for Brain Research monitors and provides guidelines on the scientific activities of the Centre. The members are as follows;

Prof. Srinath Reddy, Chairman
PHFI, Delhi

Dr. Ramesh Hariharan
Strand Life Sciences, Bangalore

Prof. Gangadhar BN
Director NIMHANS, Bangalore

Prof. Arun Kumar
MRDG-IISc, Bangalore

Prof. Anurag Agarwal
IGIB, New Delhi

Prof. Partha Majumdar
NBMG, West Bengal

Prof. Ravindra M Pandey
AIIMS, New Delhi

Prof. Vidita Vaidya
TIFR, Mumbai

Prof. Vijayalakshmi Ravindranath
Director CBR

8.6 Constitution of Internal Committee against Sexual Harassment

Dr. Bratati Kahali, Assistant Professor, CBR	: Chair
Dr. Khader Valli Rupanagudi, Scientific Officer, CBR	: Member
Dr. Latha Diwakar, Senior Scientific Officer, CBR	: Member
Ms. Rashmi Misra Founder and Chairperson, Vidya, (NGO for integrated Development for youths and adults)	: Member

8.7 Institutional Biosafety Committee

Prof. Vijayalakshmi Ravindranath, Director, CBR	: Chair
Prof. Anita Mahadevan, NIMHANS,Bangalore	: DBT Nominee
Dr. Jonas Sundarakumar, Research Psychiatrist	: Biosafety Officer
Dr. Ravi Muddashety, InStem, Bangalore	: Outside Expert
Dr Ganesh Chauhan, Assistant Professor, CBR	: Member
Dr Bratati Kahali, Assistant Professor, CBR	: Member
Dr Suresh S N, Inspire Faculty, CBR	: Member
Dr Khader Valli Rupanagudi	: Member
Dr Smitha Karunakaran, Assistant Professor, CBR	: Secretary

8.9 People at CBR

8.9.1

Academic Staff

Director

Prof. Vijayalakshmi Ravindranath

Associate Professor

Prof. Uma S Ranjan

Assistant Professor

Dr. Ganesh Chauhan

Dr. Bratati Kahali

Dr. Smitha Karunakaran

Dr. Vivek Tiwari

Inspire Faculty Fellow

Dr. Suresh S N

Visiting Faculty

Prof. Sivakumar P T
Dept. of Psychiatry
NIMHANS, Bangalore

Prof. Ganesan Venkatasubramanian
Dept. of Psychiatry
NIMHANS, Bangalore

Prof Girish N Rao
Dept. of Epidemiology
NIMHANS, Bangalore

Prof Naren P Rao
Dept. of Psychiatry
NIMHANS, Bangalore

Prof. Gaiti Hasan
Senior Professor. (Retd) SERB Distinguish Fellow
NCBS, TIFR, Bangalore

Dr. Sanjaya Viswamitra
Dept. of Radiology
Sri Sathya Sai Institute of Higher Medical Sciences, Whitefield, Bangalore

Adjunct Faculty

Prof. Y Narahari
Dept of Computer Science and Automation, IISc

Prof. Govindan Rangarajan
Dept of Mathematics, IISc

Prof. H P Khincha
Prof. (Retd)
Dept. of Electrical Engg, IISc

Dr. Sridharan Devarajan
Centre for Neuroscience,IISc

Prof. Arun Kumar
Department of Molecular Reproduction, Development and Genetics (MRDG),
IISc

8.9.2 Scientific:

Sr. Scientific Officer /Scientific Officer

Dr. Latha Diwakar	Ms. Kiran Chaudhary
Dr. Khader Valli Rupanagudi	Dr. Shobha Anilkumar

8.9.3 Technical:

Technical Assistant

Mr. Karthik S	Mr. Sangeethkumar Saminathan

Lab Assistant

Mr. Mohana C	Mr. Rajesh G

8.9.4 Administrative:

Special Officer

Mr. R Mohan Das

Executive Assistant

Ms. Aruna Poojary	Ms. Sudha Srikanth
Ms. Sudha Rani P	

Administrative Assistant

Mr. Ravi Kumar K L

8.9.5 Other Staff

Project Engineer

Mr. Sudarshan Rao

Ph. D Students

Ms. Soumi Chaudhury	Mr. Shrihari A
Ms. Diksha Chaudhuri	Mr. Barathan G
Ms. Krithika S	Ms. Haseena P A

Research Psychiatrist/ Psychiatrist

Dr. Jonas Sundarakumar	Dr. Sujai R

Medical Officer

Dr. Babu Dilip	Dr. Vinay Kumar B R

Post-Doctoral Fellows

Dr. Abhiram P N	Dr. Devendra Meena
Dr. Vishwas Yadawad	Dr. Shashank Kumar Maurya
Dr. Praveen S R	Dr. Anusha A S
Dr. Ammu Lukose	Dr. Aarti Rana
Dr. Manasi Oza	

Project Manager

Dr. Prathima Arvind

Research/Psychologist

Dr. Siddharth Dutt	Ms. Uma V
Ms. Mino Susan Joseph	Ms. Aruna N
Mr. K.V. Rahul	Mr. Rajakumar K M

Project Associate

Mr. Abhishek Panda	Mr. Bharatesh R Shiraguppi

Junior Research Fellow

Mr. Sheldon D Silva

Data Analyst

Mr. Naveenan S

Mr. Anand Kumar E

Project Assistant

Ms. Shreya Jha

Ms. Ruby Gupta

Ms. Anupriya S

Ms. Medha Sharma

Ms. Agarwal Ruchika Mahesh

Ms. Harshitha A

Ms. Pavani R

Ms. Priya Suresh

Field Staff:

Mr. Ramesh K – Office Manager

Mr. Rajesh M D – Field Data Supervisor

Mr. Harikrishna G – Field Data Collector

Mr. Yashwanthkumar K - Field Data Collector

Mr. Shashikumar - Field Data Collector

Mr. Shivaraj S – Field Data Collector

Mr. Gangaraja V - Field Data Collector

Ms. Priyanka R - Field Data Collector

Ms. Gamana T – Field Data Collector

Ms. Gayathri S – Nurse

Ms. Shyalashree Deepak – Nurse

Ms. Swathishree A N – Nurse

Ms. Nethravathi – Nurse

Ms. Pavithra K V – Nurse

Ms. Sujatha S N – Nurse