# Sadhana Singh, Ph.D.

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# **OBJECTIVE**

To secure a responsible position in an organization where I can utilize my scientific skills and knowledge for the advancement of science and improvement of my professional and personal skills.

# **EDUCATION**

- ❖ Ph.D (Physics) (July 2016) from NMR Research Centre, Institute of Nuclear Medicine and Allied Sciences (INMAS), Defence Research & Development Organization (DRDO), Delhi and Department of Physics, Bharathiar University, Coimbatore on the topic entitled "Assessment of metabolic and cognitive impairments in endocrine and neuro-developmental disorders using advanced imaging techniques with special reference to MRI"
- M.Sc (2007-2009), Physics from RDVV, Jabalpur (M.P.), INDIA. Gold Medalist in M.Sc. (Physics) with 74.58%
- ❖ B.Sc (2004-2007), Physics, Chemistry, Maths from RDVV, Jabalpur (M.P.), INDIA with 64.61%

# **WORKING EXPERIENCE**

- ➤ Currently joined as a **Research Scientist** at Centre for Brain Research, Indian Institute of Science (IISc), Bangalore–560012. (25 April 2022- till date).
- ➤ Working as an MRI Scientist at The University of Trans-Disciplinary Health Sciences and Technology, 74/2, Jarakabande Kaval, Post Attur via Yelahanka, Bengaluru—560064. (1 Jan. 2021-24 April 2022).

- ➤ Working experience as a Postdoctoral Fellow at University of California, Los Angeles, California, USA on the topic entitled "Evaluation of brain structural integrity and blood brain barrier function in patients with single ventricle congenital heart disease using non-invasive magnetic resonance imaging procedures". (Oct. 2016-Oct. 2018)
- ➤ Research Experience in the field of MR Imaging for "Assessment of metabolic and cognitive impairments in endocrine and neuro-developmental disorders using MRI procedures" under the supervision of Dr. Subash Khushu, Scientist 'G' & HOD, NMR Research Centre, INMAS, DRDO, Delhi 110054. (2010 to 2016)
- ➤ Six months project at Department of Physics and Electronics, R.D.V.V., Jabalpur on "Origin of Cosmic Rays" under the supervision of Dr. Santosh Kumar, Professor and Head of Department.

### SKILLS AND EXPERIENCE

- Working experience with 3T System (Skyra and Prisma, Siemens) and handling experiments independently on 3T Human MR System
- Working experience with 7T Animal MR System (a Bruker USR 70/30).
- Acquisition of MRI procedures (High-resolution T1-weighted imaging, T2- and T2 starweighted imaging, Diffusion tensor imaging (DTI), task-based and resting state fMRI,
  3D pCASL, Single voxel MR Spectroscopy, MEGA-PRESS (for GABA and GSH).
- Voxel based morphometry (VBM) and T2-Relaxometry analysis using SPM.
- DTI, Myelin mapping, Iron mapping and 3D pCASL data analysis using TBSS and SPM.
- Designing of paradigms on Nordic Neuolab for doing fMRI studies.
- Task-based fMRI applications and Data processing on SPM based MATLAB.
- Experience of performing EEG experiments.
- Resting state fMRI and their data processing using FSL, SPM and CONN software.
- Cortical thickness analysis using Freesurfer.
- Acquaintance of LCModel and GANNET software for processing of in-vivo MRS data.

• Knowledge of statistical analysis software like SPSS, R for processing of multivariate data analysis obtained from MRI.

#### RESEARCH INTERESTS

My main research interest lies in the applications of new MRI methods for the study of cognitive neuroscience.

- 1. Brain changes in ageing population and different diseased conditions.
- 2. Working in Centre for Brain Research (CBR) Srinivaspura Aging, Neuro Senescence and COGnition study (SANSCOG) and Tata Longitudinal Study of Aging (TLSA) projects.
- 3. Functional and structural brain connectivity changes as measured by resting state functional connectivity, diffusion imaging, high-resolution anatomical MRI in ageing population, and different diseased conditions.
- 4. Brain structural integrity and blood brain barrier function changes in patients with single ventricle congenital heart disease using non-invasive MRI procedures.
- 5. Assessment of metabolic and cognitive impairments in thyroid and schizophrenia patients using MRI procedures.

### FELLOWSHIPS AND AWARDS

- Gold medalist in M.Sc. (Physics)
- DRDO Fellowship for Ph.D., Physics (2010-2015)
- EPA 2013 Travel Award for attending 21st European Congress of Psychiatry (EPA 2013) held at Nice, France in April 2013.
- Recipient of Travel award from DST, Govt. of India to attend and present paper (Poster) in 21st European Congress of Psychiatry (EPA 2013) held at Nice, France in April 2013.
- ICMR Senior Research Fellowship (2015)
- ISMRM Educational stipend for attending ISMRM-ESMRMB meeting in Paris, France (2018)

#### PROFESSIONAL MEMBERSHIPS

- Society for Neuroscience SfN (2017-present)
- NMR Society (Life membership)
- International Society for Magnetic Resonance in Medicine, ISMRM (2012-present)

### CONFERENCES/WORKSHOPS ATTENDED

- Attended "Joint Annual Meeting ISMRM-ESMRMB" held at Paris, France, 16-21 June, 2018.
- Attended "21st Society for Neuroscience Conference" held at Washington DC, USA, 11-15 November, 2017.
- Attended "21st Conference of National Magnetic Resonance Society" held at Guru Nanak Dev University, Amritsar, India, 6-9 March, 2015.
- Attended an International Conference "1<sup>st</sup> Global Conference of Biological Psychiatry" held at New Delhi, India, 25-28 September, 2014.
- Attended an International Conference "21st European Congress of Psychiatry (EPA 2013)" held at Nice, France from 6th to 9th April, 2013.
- Workshop on "NMR in Defence Applications" held at INMAS, DRDO, Delhi, India, 26-27 November, 2012.
- Workshop on "In vivo MR Spectroscopy" held at AIIMS, New Delhi, India, 15-16 September, 2012.
- Symposium on New developments in NMR and conference of National Magnetic Resonance Society (NMRS 2012) at Bangalore (February 2012).
- Attended CEP course on "High Resolution Biomedical NMR on small animals and body fluids" held at INMAS, DRDO, New Delhi (Dec.2010).
- Attended CEP course on "Emerging Applications of Lasers" held at LASTEC, DRDO, New Delhi (Aug., 2010).

# REVIEWER OF THE JOURNAL

Indian Journal of Psychological Medicine (IJPM)

- Frontiers in Oncology (as a Review Editor)
- Frontiers in Neuroscience
- Frontiers in Psychiatry
- Clinical Interventions in Aging
- Scientific Reports
- BMC Psychiatry

# **PUBLICATIONS**

- S. Singh, P.K. Malo, A. Stezin, A.L. Mensegere, T.G. Issac. Hippocampal subfields volume changes and its correlation with memory functions in patients with mild cognitive impairment. *Ageing and Health Research*. 2024. 4(1); <a href="https://doi.org/10.1016/j.ahr.2024.100183">https://doi.org/10.1016/j.ahr.2024.100183</a>.
- A. Ghosh, <u>S. Singh</u>, Monisha S., T. Jagtap, T.G. Issac. Music and the Aging Brain— Exploring the role of long-term carnatic music training on cognition and grey matter volumes. *J Neurosci Rural Pract*. 2024.
- ➤ M. Kumar, <u>S. Singh</u>, S. Modi, P. Rana, S. Modi, M. D'souza, T. Sekhri, S. Khushu. Cortical gray matter thickness and volume changes and its association with memory functions in hyperthyroid patients. *Neuroendocrinology*. 2023. doi: 10.1159/000536027.
- A.B. George, R.P. Beniwal, <u>S. Singh</u>, T. Bhatia, S. Khushu, S.N. Deshpande. Association between thyroid functions, cognition, and functional connectivity of the brain in early-course schizophrenia: A preliminary study. *Industrial Psychiatry Journal*. 2023; 32(Suppl 1): S76-S82.
- ➤ <u>S. Singh\*(Corresponding Author)</u>, P.K. Malo, A.L. Mensegere, T.G. Issac. Letter to Editor: Atrophy asymmetry in hippocampal subfields in patients with Alzheimer's disease and mild cognitive impairment. *Exp Brain Res.* 2023; 241(9): 2205. Doi: 10.1007/s00221-023-06673-y.
- M. Kumar, S. Singh, P. Rana, P. Kumar, T. Sekhri, R. Kanwar, M. D'souza, S. Khushu. Neuro-metabolite changes in hyperthyroid patients before and after anti-thyroid treatment: An in-vivo 1H MRS Study. *Front. Hum. Neurosci.*, 2021.
- ➤ M. Kumar, <u>S. Singh</u>, P. Rana, S. Modi, T. Sekhri, R. Kanwar, M. D'souza, S. Khushu. Brain functional connectivity in patients with hyperthyroidism after antithyroid treatment. *J Neuroendocrinol*. 2022;34(1): e13075. doi: 10.1111/jne.13075.

- C. Cabrera-Mino, B. Roy, M.A. Woo, <u>S. Singh</u>, S. Moye, N.J. Halnon, A.B. Lewis, R. Kumar, N. Pike. Reduced brain mammillary body volumes and memory deficits in adolescents who have undergone the Fontan procedure. *Pediatric Res.* 2020; 87(1): 169-175.
- S. Singh, B. Roy, N. Pike, E. Daniel, L. Ehlert, A. Lewis, N. Halnon, M.A. Woo, R. Kumar. Altered Brain Diffusion Tensor Imaging Indices in Adolescents with the Fontan Palliation. *Neuroradiology*, 2019. 61(7):811-824.
- ➤ N. Pike, B. Roy, R. Gupta, <u>S. Singh</u>, M.A. Woo, N.J. Halnon, A.B. Lewis, R. Kumar. Brain abnormalities in cognition, anxiety, and depression regulatory regions in adolescents with single ventricle heart disease. *J Neurosci. Res.* 2018. 96(6):1104-1118.
- ➤ <u>S. Singh</u>, R. Kumar, B. Roy, M.A. Woo, A. Lewis, N. Halnon, N. Pike. Regional brain gray matter changes in adolescents with single ventricle heart disease. *Neurosci Lett.* 2018; 665:156-162.
- A. Sharma, A. Kumar, <u>S. Singh</u>, T. Bhatia, R.P. Beniwal, S. Khushu, K. Prasad, S.N. Deshpande. Altered resting state functional connectivity in early course schizophrenia. *Psychiatry Research: Neuroimaging*. 2018; 271: 17-23.
- ➤ <u>S. Singh</u>, S. Khushu, P. Kumar, S. Goyal, T. Bhatia, S.N. Deshpande. Evidence for regional hippocampal damage in patients with schizophrenia. *Neuroradiology*. 2017; 60(2):199-205.
- ➤ <u>S. Singh</u>, K. Singh, R. Trivedi, S. Goyal, P. Kaur, N. Singh, T. Bhatia, S.N. Deshpande, S. Khushu. Microstructural abnormalities of uncinate fasciculus as a function of impaired cognition in schizophrenia: A DTI study. *J Biosci.* 2016; 41(3):419-26.
- **S.** Singh, P. Rana, P. Kumar, L.R. Shankar, S. Khushu. Hippocampal neurometabolite changes in Hypothyroidism: An in-vivo 1H MRS Study before and after thyroxine treatment. *J Neuroendocrinol*. 2016; 28(9). doi: 10.1111/jne.12399.
- > <u>S. Singh</u>, S. Modi, S. Goyal, P. Kaur, N. Singh, T. Bhatia, S.N. Deshpande, S. Khushu. Functional and structural abnormalities associated with empathy in patients with schizophrenia: An fMRI and VBM study. *J. Biosci.* 2015; 40(2): 355-64.
- S. Singh, M. Kumar, S. Modi, P. Kaur, L.R. Shankar, S. Khushu. Alterations of functional connectivity among resting-state networks in hypothyroidism. *J Neuroendocrinol.* 2015; 27(7): 609-15.

- S. Singh, R. Trivedi, K. Singh, P. Kumar, L.R. Shankar, S. Khushu. Diffusion tensor tractography in hypothyroidism and its correlation with memory function. *J Neuroendocrinol.* 2014; 26(11):825-33.
- ➤ B.S.H. Kumar, S.K. Mishra, R. Trivedi, <u>S. Singh</u>, P. Rana, S. Khushu. Demyelinating evidences in CMS rat model of depression: A DTI study at 7T. *Neuroscience*. 2014; 275:12-21.
- S. Singh, S. Goyal, S. Modi, P. Kumar, N. Singh, T. Bhatia, S.N. Deshpande, S. Khushu. Motor Function Deficits in Schizophrenia: An fMRI and VBM study. *Neuroradiology*. 2014; 56(5): 413-22.
- ➤ D. Bagga, N. Singh, <u>S. Singh</u>, S. Modi, P. Kumar, D. Bhattacharya, M.L. Garg, S. Khushu. Assessment of abstract reasoning abilities in alcohol dependent subjects: An fMRI study. *Neuroradiology*. 2014; 56(1): 69-77.
- S. Singh, S. Modi, D. Bagga, P. Kaur, L.R. Shankar, S. Khushu. Voxel-based morphometric analysis in hypothyroidism using diffeomorphic anatomic registration via an exponentiated lie algebra algorithm approach. *J Neuroendocrinol.* 2013; 25(3): 229-34.
- ➤ B.S.H. Kumar, S.K. Mishra, P. Rana, <u>S. Singh</u>, S Khushu. Neurodegenerative evidences during early onset of depression in CMS rats as detected by proton magnetic resonance spectroscopy at 7T. *Behav Brain Res.* 2012; 232:53-59.

### PAPER PRESENTED IN CONFERENCES

- A. Ghosh, P.K. Malo, **S. Singh**, T.G. Issac. Cerebellar white matter in musicians: Less is more? AAIC 2024. Philadelphia, PA, USA. 28th July-1st August, 2024.
- ➤ S. Singh, P. Rana, P. Kumar, P. Kaur, L. Ravi Shankar, S. Khushu. Regional hippocampal changes in patients with hyperthyroidism. International Society for Magnetic Resonance in Medicine Annual Meeting, London, England, UK, May 7-12, 2022.
- ➤ X. Song, B. Roy, S. Singh, A. Sahib, N. Halnon, A. Lewis, M.A. Woo, N. Pike, R. Kumar. Regional brain resting-state neural activity in patients with single ventricle heart disease. International Society for Magnetic Resonance in Medicine Annual Meeting, Montreal, QC, Canada, May 11-16, 2019.
- ➤ S. Singh, B. Roy, X. Song, N. Halnon, A. Lewis, M.A. Woo, N. Pike, R. Kumar. Regional brain myelin changes in patients with single ventricle heart disease. International Society for Magnetic Resonance in Medicine Annual Meeting, Paris, France, June 16 21, 2018.

- ➤ S. Singh, B. Roy, N. Halnon, A. Lewis, M.A. Woo, N. Pike, R. Kumar. Regional brain changes in autonomic, mood, and cognitive control areas in Adolescents with Single Ventricle Heart Disease. International Society for Magnetic Resonance in Medicine Annual Meeting, Paris, France, June 16 21, 2018.
- X. Song, B. Roy, S. Singh, A. Sahib, C. Cabrera-Mino, G.C. Fonarow, M.A. Woo, R. Kumar. Brain Structural Impairment Associated with Aberrant Functional Responses to the Valsalva Maneuver in Heart Failure. International Society for Magnetic Resonance in Medicine Annual Meeting, Paris, France, June 16 21, 2018.
- A. Sahib, B. Roy, X. Song, S. Singh, L. Ehlert, R. Aysola, D. Kang, M.A. Woo, R. Kumar. Brain axonal and myelin changes after positive airway pressure treatment in patients with obstructive sleep apnea. International Society for Magnetic Resonance in Medicine Annual Meeting, Paris, France, June 16 21, 2018.
- ➤ B. Roy, S. Singh, X. Song, A. Sahib, C. Cabrera-Mino, G.C. Fonarow, M.A. Woo, R. Kumar. Regional Brain Iron Mapping in Patients with Heart Failure. International Society for Magnetic Resonance in Medicine Annual Meeting, Paris, France, June 16 21, 2018.
- ➤ N.A. Pike, B. Roy, S. Singh, M.A. Woo, N.J. Halnon, A.B. Lewis, R. Kumar. Reduced Regional Cerebral Blood Flow Associated with Cognitive Outcomes in Adolescents with Single Ventricle Heart Disease. Circulation; 138 (Suppl\_1): A12717-A12717.
- ➤ C. Cabrera-Mino, M.A. Woo, B. Roy, S. Singh, N.J. Halnon, A.B. Lewis, R. Kumar, N. Pike. Reduced Mammillary Body Volumes Associated with Memory Deficits in Single Ventricle Heart Disease. Circulation 138 (Suppl\_1), A12655-A12655.
- S. Moye, M.A. Woo, B. Roy, S. Singh, R. Kumar, N.A. Pike. Hippocampal Brain Volume, Single Ventricle Diagnosis, and Anxiety Predict Cognitive Deficits in Adolescents. Circulation. 2018; 138 (Suppl 1): A12726-A12726.
- N.A. Pike, S.L. Moye, B. Roy, S. Singh, N.J. Halnon, A.B. Lewis, M.A. Woo, R. Kumar. Reduced Hippocampal Volume, Mood, and Memory Deficits in Adolescents with Single Ventricle Heart Disease. Circulation 136 (suppl\_1), A15451-A15451.
- ▶ B.S.H. Kumar, D.K. Deelchand, S.K. Mishra, **S. Singh**, S. Khushu. Stress induced bioenergetic perturbations in CMS rat model of Depression an in-vivo phosphorous MRS study at 7T. International Society for Magnetic Resonance in Medicine Annual Meeting, Paris, France, June 16 21, 2018.

- ➤ S. Singh, B. Roy, N. Halnon, A. Lewis, M.A. Woo, N. Pike, R. Kumar. Brain axonal and myelin changes in patients with single ventricle congenital heart disease. Society for Neuroscience Annual Meeting, Washington, D.C., Nov 11-15, 2017.
- X. Song, B. Roy, S. Singh, A. Sahib, L. Ehlert, M. Townsley, D.W. Kang, R. Aysola, Y.E. Wen, M.A. Woo, R.M. Harper, R. Kumar. Brain regional homogeneity changes before and after positive airway pressure treatment in patients with obstructive sleep apnea. Society for Neuroscience Annual Meeting, Washington, D.C., Nov 11-15, 2017.
- L. Ehlert, B. Roy, A. Sahib, X. Song, **S. Singh**, M. Townsley, D.W. Kang, R. Aysola, Y.E. Wen, M.A. Woo, R.M. Harper, R. Kumar. Diffusion tensor imaging shows brain tissue changes before and after positive airway pressure treatment in patients with obstructive sleep apnea. Society for Neuroscience Annual Meeting, Washington, D.C., Nov 11-15, 2017.
- N. Pike, S. Moye, B. Roy, S. Singh, N. Halnon, A. Lewis, M.A Woo, R. Kumar. Reduced hippocampal volume in adolescents with single ventricle heart disease. American Heart Association Annual Meeting, Anaheim, CA, Nov 11-15, 2017.
- N.A. Pike, S. Singh, B. Roy, M.A. Woo, A.B. Lewis, R. Kumar. Regional gray matter volume changes in single ventricle heart disease compared to controls. WCPCCS, Barcelona, Spain, July 16-21, 2017.
- S. Khushu, S. Singh, P. Rana, P. Kumar, L.R. Shankar. Neurometabolite alterations in hippocampus in hypothyroid patients: An in-vivo <sup>1</sup>H MRS Study. International Society for Magnetic Resonance in Medicine Annual Meeting, Toronto, Ontario, Canada, May 30-June 5, 2015.
- S. Khushu, S. Singh, M. Kumar, S. Modi, P. Kaur, L.R. Shankar. Altered resting state functional connectivity in hypothyroidism. International Society for Magnetic Resonance in Medicine Annual Meeting, Toronto, Ontario, Canada, May 30 June 5, 2015.
- ➤ S. Singh, P. Rana, P. Kaur, L.R. Shankar, S. Khushu. Hyperthyroidism induced metabolic changes in hippocampus: A <sup>1</sup>H MRS study. 21st Conference of NMRS, Gurunanak Dev University, Amritsar, March 6-9, 2015.
- ➤ S. Singh, M. Kumar, A. Sharma, S. Modi, P. Kaur, T. Bhatia, S.N. Deshpande, S. Khushu. Disrupted functional connectivity in schizophrenia: A resting state fMRI study. 23<sup>rd</sup> European Congress of Psychiatry, Vienna, Austria, March 28-31, 2015.
- ➤ S. Singh, K. Singh, R. Trivedi, S. Goyal, P. Kaur, M. Popli, T. Bhatia, S.N. Deshpande, S. Khushu. Neuropsychological correlates of white matter abnormalities in schizophrenia patients: A DTI study. 1<sup>st</sup> Global Conference of Biological Psychiatry, New Delhi, India, Sept. 25-28, 2014.

- ➤ S. Singh, S. Modi, S. Goyal, P. Kaur, N. Singh, T. Bhatia, S.N. Deshpande, S. Khushu. Empathy deficits in schizophrenia: An fMRI and VBM study. International Cognitive Neuroscience Conference, Brisbane, Australia, July 27-31, 2014.
- S. Khushu, S. Singh, R. Trivedi, K. Singh, P. Kumar, L.R. Shankar. Correlation of Diffusion Tensor Imaging (DTI) measures with memory dysfunction scores in hypothyroid patients. International Society for Magnetic Resonance in Medicine Annual Meeting, Milan, Italy, May 10-16, 2014.
- ➤ S. Singh, R. Trivedi, K. Singh, P. Kumar, L.R. Shankar, S. Khushu. Hypothyroidism induced changes in the Brain using Diffusion Tensor Imaging. 30<sup>th</sup> Annual Scientific Meeting, ESMRMB 2013, Toulouse, France, Oct. 3-5, 2013.
- ➤ S. Singh, S. Goyal, S. Modi, P. Kumar, N. Singh, T. Bhatia, S.N. Deshpande, S. Khushu. Motor impairment in schizophrenics: A combined fMRI and VBM study. International Society for Magnetic Resonance in Medicine Annual Meeting, Salt Lake City, Utah, USA, April 20-26, 2013.
- ➤ S. Singh, S. Goyal, S. Modi, P. Kumar, N. Singh, T. Bhatia, S.N. Deshpande, S. Khushu. A combined fMRI and VBM study to show motor deficits in schizophrenia versus control subjects during a simple motor task. 21<sup>st</sup> European Congress of Psychiatry, Nice, France, April 6-9, 2013.
- ➤ S. Singh, R. Trivedi, K. Singh, S. Goyal, P. Kumar, N. Singh, T. Bhatia, S.N. Deshpande, S. Khushu. Fractional Anisotropy (FA) and Mean Diffusivity (MD) Changes in Schizophrenia: A Diffusion Tensor Imaging (DTI) Approach. 19<sup>th</sup> Conference of NMRS, IIT, Bombay, Feb. 3-6, 2013.
- ➤ S. Singh, S. Modi, P. Kaur, D. Bagga, L.R. Shankar, S. Khushu. Effect of Hypothyroidism on Structural Organization of the Human Brain: A Voxel-Based Morphometric Study using DARTEL. 29<sup>th</sup> Annual Scientific Meeting, ESMRMB 2012, Lisbon, Portugal, Oct. 4-6, 2012.
- ➤ S. Singh, S. Modi, D. Bagga, L.R. Shankar, T. Sekhri, S. Khushu. Assessment of motor function deficit in thyroid dysfunction: An fMRI study. 18<sup>th</sup> National Magnetic Resonance Society Meeting, IISc, Bangalore February 5-8, 2012.
- ➤ B.S.H. Kumar, R. Trivedi, S.K. Mishra, S. Singh, R.P. Tripathi, S. Khushu. Quantitation of Diffusion Indices in CMS rat model of depression A DTI approach. International Society for Magnetic Resonance in Medicine Annual Meeting, Melbourne, Australia, May 5-11, 2012.
- ➤ B.S.H. Kumar, S.K. Mishra, P. Rana, S. Singh, R.P. Tripathi, S. Khushu. Neuroinflamatory evidence during early onset of depression in CMS rats as

detected by proton MRS at 7T. International Society for Magnetic Resonance in Medicine Annual Meeting, Melbourne, Australia, May 5-11, 2012.

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- ➤ B.S.H. Kumar, R. Trivedi, S.K. Mishra, **S. Singh**, R.P. Tripathi, S. Khushu. FA and MD changes in CMS rat model of depression A DTI approach. 18<sup>th</sup> National Magnetic Resonance Society Meeting, IISc, Bangalore February 5-8, 2012.

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# **DECLARATION**

I hereby informed that the above-mentioned information is true to the best of my knowledge.

Date: 23/04/2024

**Place: Bangalore** 

Sadhana Singh