

# **NEUROSCIENCES IN INDIA 2009**

*Editors*  
**B.N. Dhawan  
P.K. Seth**



**Indian Academy of Neurosciences (IAN)**



**Council of Scientific and Industrial Research  
(CSIR)**

Printed in 2009

©: Editors

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without written permission of the editors.

**Mailing Address:**

**Prof. B.N. Dhawan**

Former Director, CDRI  
3, Rama Krishna Marg  
Faizabad Road, Lucknow  
Email: bndhawan@hotmail.com

**Prof. P.K. Seth**

Former Director, IITR &  
Chief Executive Officer  
Biotech Park  
Sector G, Jankipuram,  
Kursi Road, Lucknow  
Email: prahladseth@gmail.com

Dr. Vinay K. Khanna, Secretary HQ, Indian Academy of Neurosciences, Indian Institute of Toxicology Research, M.G. Marg, Lucknow - 226 001, India  
Council of Scientific and Industrial Research, Anusandhan Bhawan, 2 Rafi Marg, New Delhi - 110 001

---

**Published by:**

Indian Academy of Neurosciences (IAN) &  
Council of Scientific and Industrial Research (CSIR), New Delhi

**Printed at:** Maruti Scanners, Lucknow (M) 9839055651

# CONTENTS

Message	
<i>Director General, CSIR</i>	
Preface	
<i>B.N. Dhawan and P.K. Seth</i>	
Neurosciences in India – An Overview .....	1
<i>P.N. Tandon</i>	
Neuroanatomy .....	19
<i>Shashi Wadhwa</i>	
Neurophysiology .....	49
<i>K.N. Sharma and S. Dua Sharma</i>	
Neurochemistry .....	87
<i>A.Borah, R.Usha and K.P. Mohanakumar</i>	
Neuropharmacology .....	147
<i>Ram Raghubir and C. Nath</i>	
Neuropathology .....	175
<i>Sarala Das &amp; S. K. Shankar</i>	
Neurotoxicology of Chemicals.....	233
<i>Vinay K. Khanna, Farhat Jaffery and Prahlad K. Seth</i>	
Neuromicrobiology .....	269
<i>Aditi Singh, Shailendra K. Saxena, Niraj Mishra &amp; Asha Mathur</i>	
Studies on Aging of the Brain .....	319
<i>Ishan Patro and Nisha Patro</i>	
Neural Transplantation: A Review .....	335
<i>Ashok K. Agrawal and Rajnish K. Chaturvedi</i>	
Neuroendocrinology .....	355
<i>Saptarshi Bhattacharya and Nikhil Tandon</i>	
Status of Psychiatric Research .....	365
<i>Anil K. Agarwal</i>	
Neurosurgery in Last Two Decades .....	375
<i>A.K. Mahapatra</i>	
Contribution of Indian Neuroscientists in USA .....	415
<i>Ghanshyam N. Pandey</i>	
Cognitive Neuroscience and Neuropsychology .....	451
<i>Shobini L. Rao</i>	
CSIR : Initiatives in Neurosciences .....	501
<i>Lalita Goyal</i>	
ICMR : Initiatives in Neurological Disorder Research .....	505
<i>Meenakshi Sharma and Bela Shah</i>	
History of IAN .....	511
<i>Mahdi Hasan</i>	
Contributors .....	521



**प्रो. समीर के. ब्रह्मचारी**  
महानिदेशक, वै.ओ.अ.प.  
एवं सचिव, भारत सरकार  
वैज्ञानिक तथा औद्योगिक अनुसंधान विभाग

**Prof. Samir K. Brahmachari**  
Director General, CSIR  
& Secretary, Government of India  
Department of Scientific & Industrial Research



**वैज्ञानिक तथा औद्योगिक अनुसंधान परिषद्**  
अनुसंधान भवन, 2, रफी मार्ग, नई दिल्ली-110001  
**COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH**  
Anusandhan Bhawan, 2, Rafi Marg, New Delhi-110001



#### MESSAGE

I am delighted to learn that Indian Academy of Neurosciences (IAN) is bringing out a Status Report on Neurosciences in India covering the studies undertaken during the last two decades.

Neuroscience is one of the fastest growing disciplines in biology and behavioral sciences. During the past two decades, a significant amount of work has been undertaken in India to understand the mystery of brain mechanisms of neurological disorders including the functional genomics of certain disorders and adverse effects of chemicals on brain as well as in diagnosis and treatment of nervous system disorders. CSIR laboratories have structured research programmes on fundamental and applied aspects of neuroscience. CSIR also provides extramural support to neuroscience research.

Indian Academy of Neurosciences, a premier academy of our country, has emerged as a multidisciplinary organization of neuroscience. It plays a significant role in bringing basic and clinical neuroscientists together and provides a unique platform for exchange of knowledge and has created wider awareness about brain functioning and brain related disorders.

I am sure that this status report would provide a lucid account of neuroscience studies undertaken in the country, which will be useful to students, researchers and the scientific community at large, both nationally and internationally.

  
Samir K. Brahmachari



## PREFACE

Neuroscience is a rapidly growing discipline world over and the advances in molecular, electrophysiology and computational neuroscience in recent years have today enabled much detailed understanding of the complex processes occurring within a neuron. The scope of neurosciences has now broadened to include any systematic scientific, experimental and theoretical investigations of central and peripheral nerves system of biological organisms.

Neuroscience studies are being carried out in several research institutions and Universities in India. Earlier the status of neurosciences studies was brought out by the Neurological Society of India, Trivandrum and Council of Scientific and Industrial Research, New Delhi in 1989. A significant quantum of work has been undertaken in the country during the last two decades in India to reveal the mysteries of the brain at cellular and molecular level. Their have been encouraging developments enabling the growth of neurosciences in the country since then. Establishment of a National Brain Research Centre (NBRC) in Manesar permitting interdisciplinary work in emerging areas, setting up of neuroscience centres and initiation of post graduate courses at some universities and institutions are few examples. The funding by Department of Biotechnology (DBT), Department of Science and Technology (DST), Council of Scientific and Industrial Research (CSIR) and Indian Council of Medical Research (ICMR) in neurosciences has also been enhanced. The Indian Academy of Neurosciences has emerged as the largest body of the neurosciences representing basic and clinical neuroscientists. It is playing a significant role in bringing the basic and clinical neuroscientists together.

We gratefully acknowledge the financial support provided by Council of Scientific and Industrial Research (CSIR) and thank to all the contributors for reviewing the status of work being carried out in area of their expertise. We are particularly grateful to Prof. P.N. Tandon for contributing an overview on Neurosciences and going through the manuscripts and providing useful suggestions.

We hope that this Status Report on Neurosciences during the last two decades would be useful to students, researchers and national and international scientific community.

**B.N. Dhawan  
P.K. Seth  
Editors**

