



# Trends and roadblocks in proteomics research in India

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**A**t the turn of this century, the newly emerging field of 'proteomics' began showing promise in various aspects of clinical and industrial research. While India was not able to play a vital role in genome sequencing projects, in the post-genomic era the country is playing an increasingly significant role in global proteomics research<sup>1,2</sup>.

In 2005, eminent Indian scientist and late President A P J Abdul Kalam noted that India has the "potential to tap research opportunities in proteomics and biochips to help understand the biological processes and treat diseases. This is possible even though the country has missed the opportunity to partner in the human genome project"<sup>3</sup>.

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## The booming Indian proteomics scene

In India, proteomics research was initiated over a decade ago<sup>4</sup>. Research groups in premier institutes started adopting proteomics technologies in biological research projects and the emerging field got considerable support from central research agencies<sup>5</sup>. In 2009, the Proteomics Society, India (PSI) was established as a platform to foster interactions within the Indian proteomics community and to encourage exchange of ideas, enhance collaborations and boost innovations at the national and international level.

Although the development of proteomics research in India was rather slow in the beginning, the last few years have seen a significant expansion in the proteomics community<sup>6</sup>. Presently, there are over a hundred research laboratories in 76 academic or research institutes across India involved in proteome-level research investigations (Figure 1).

Several research groups from India are actively involved in world-class research on proteomics of different human cancers and infectious diseases, and are also effectively contributing towards diverse aspects of bacterial, plant and animal proteomics at the global level<sup>1</sup>.



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## Notable achievements

High quality data repositories are indispensable to the globalisation of proteomics research. Researchers from the Institute of Bioinformatics (IOB), Bengaluru have developed the Human Protein Reference Database (HPRD) and Human Proteinpedia<sup>7</sup> ([www.humanproteinpedia.org/](http://www.humanproteinpedia.org/)), while important contribution in the Human Protein Atlas (<http://www.proteinatlas.org/>) has come from researchers at Lab SurgPath, Mumbai.

Creation of the 'Human Proteome Map' has been one of the most remarkable achievements in proteomics research in recent times. Pandey and Kuster labs have independently drafted the 'Human Proteome Maps' using high-resolution mass spectrometry<sup>8,9</sup>. More recently, a comprehensive tissue-based map of the Human Proteome using antibody-based microarrays was reported from Uhlén's group<sup>10</sup>. Indian researchers played a significant role in two of these three important projects contributing towards the characterisation of each and every protein present in the human body<sup>2</sup>.

The Indian proteomics community has been on top of the learning curve, being exposed to international proteomics conferences, meetings and workshops from the very beginning of the proteomics boom. Besides, Indian researchers have developed various e-learning

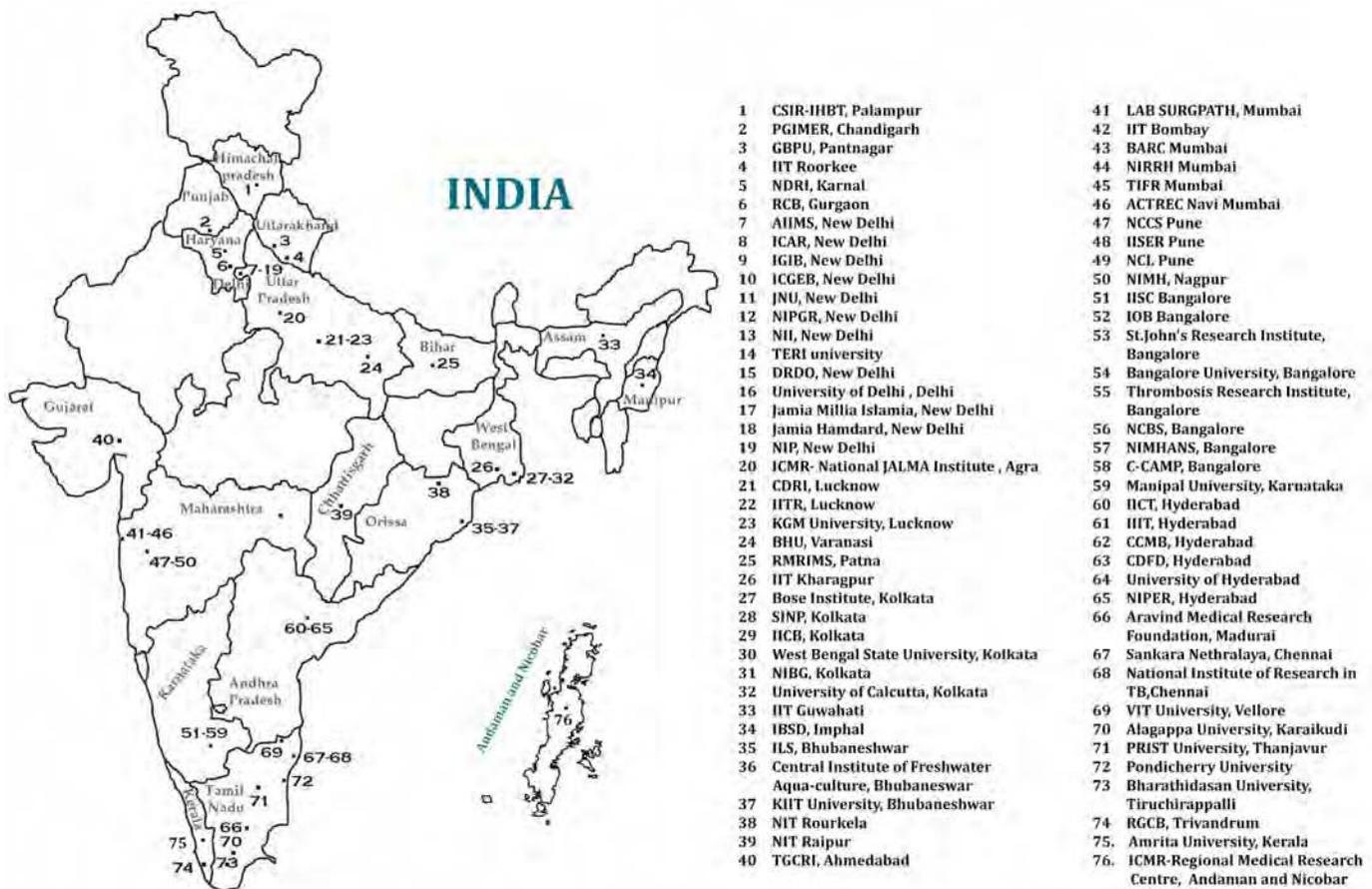
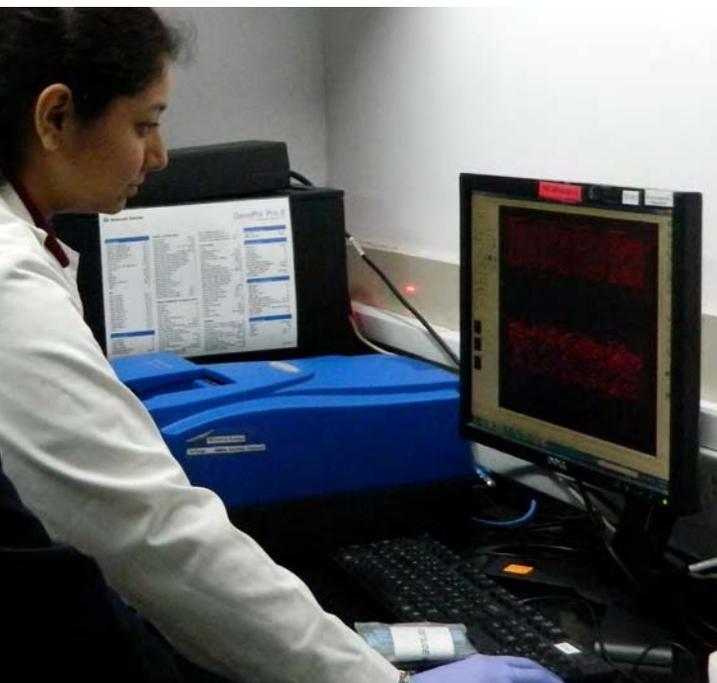


Figure 1. Laboratories across India involved in proteome-level research investigations.



resources on proteomics, such as one of the first virtual lab projects dedicated to proteomics (<http://iitb.vlab.co.in/?sub=41&brch=118>) at the Indian Institute of Technology Bombay, Mumbai<sup>11</sup>. The effort is now recognised internationally and is being incorporated as a part of the International Proteomics Tutorial Programme (IPTP) conducted by the Human Proteome Organization (HUPO) and the European Proteomics Association (EuPA).

Keeping pace with the growing proteomics research efforts, India is actively participating in global proteomics organisational activities and initiatives including the Human Proteome Organization (HUPO), Chromosome centric Human Proteome Project (C-HPP), Asia Oceania Human Proteome Organization (AOHUPO), International Plant Proteomics Organization (INPPO) and Asia Oceania Agricultural Proteomics Organization (AOAPO)<sup>2, 6</sup>. India's involvement in cutting-edge proteomics research is receiving worldwide attention. Consequently, the 6<sup>th</sup> Annual Meeting of PSI – International Proteomics Conference on 'Proteomics from Discovery to Function' (December 2014) was attended by eminent scientists involved in path-breaking proteomics research and the pioneers of the Human Proteome Organization (HUPO)<sup>12, 13</sup>. This year the *Journal of Proteomics*, which serves as an official journal of the EuPA, is also publishing a special issue on 'Proteomics in India' to highlight the recent growth of proteomics research in India.

## Hurdles and the way ahead

Despite some success stories, India is still a long way off from successful translation of promising laboratory findings into practical applications. However, armed with technology and expertise India is capable of this translation through long-term multi-disciplinary and multi-institutional research programmes. Such translational research requires advanced infrastructure and substantial enduring financial support, which isn't available to most research laboratories in low and middle-income countries such as India.

Lack of adequate and long-term funds is one of the prime reasons behind the failure of many promising research ventures. These limitations can be overcome with pre-competitive data sharing of existing resources and data repositories, collaborations, joint grant applications and linkages with relevant industries. India needs focussed policies to promote translational research through specialised mega projects. This would ensure that the benefits of proteomics technologies reach one and all.

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