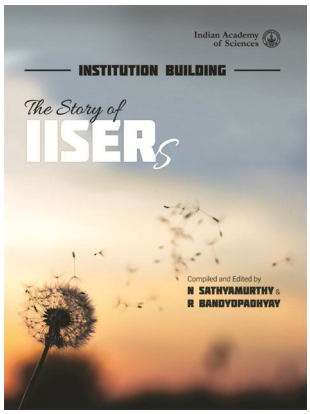

Institution Building: The Story of IISERs. Compiled and edited by N. Sathyamurthy and R. Bandyopadhyay. Indian Academy of Sciences, C.V. Raman Avenue, Sadashivanagar, Bengaluru 560 080. 2018. xvi + 132 pages. Price: Rs 200.

India has the largest population in the higher education age group (18–23 years) in the world, estimated to be about 150 million. However, the number of students enrolled in colleges is about 34 million only, unlike school education, where access is almost universal. According to the All India Survey on Higher Education (2018), the gross enrollment ratio (GER) in this sector is about 25.2 (2016–17), which means out of every 100 eligible students, only 25 or so go for higher education.

There are nearly 900 universities, including 260 in the private sector, with about 40,000 colleges in the country, including some run by the corporate sector. The share of the unaided private-sector colleges has increased since 2001. Nearly 12% of those enrolled have opted for distance education.

The content of the courses in higher education is heavily tilted towards social sciences. At the university level, about 40% of students are enrolled in arts and humanities, followed by science (16%), engineering and teaching (15.6%), and commerce (14.1%). Only a third of the 40,000 colleges run postgraduate courses, and a very small number (1.7%) offers Ph D programmes. Most of the premier institutions cater to one particular stream, such as engineering or management, while science education suffers. Moreover, higher education has become an arena for politics, cronyism and corruption, and the universities are seen as business ventures and cash cows.

The science curriculum in many universities is mostly outdated and irrelevant. The learning mode is exam-centric, based on rote learning. There is hardly any chance for students to study subjects of their choice. Their school experience conditions them to stick to what they liked in the curriculum. There is no scope for 'unconditioning' their minds at a later stage. Many regions in the country do not have easy access to higher education, not to speak of science courses. There are significant disparities in the higher education in terms of gender and social groups. Moreover, there is little autonomy for colleges who run science courses. There are too many regulatory bodies dealing with higher education.

This state of affairs is reflected in the global rankings of Indian universities. According to the Times Higher Education, Emerging Economics University rankings, India (which has improved its representation with 25 universities in the top 200 this year) is far behind China, that has four in the top five. In the Asia University Rankings (2018) by Quacquarellii Symondes or QS, IIT-Bombay ranks first among the top 10 in the country, but slides to 33 in the ranking of Asian universities.

Some educationists were of the view that the shortcomings could be addressed in an innovative way by creating a novel institutional framework dedicated to science. The idea was realized in 2006, when the former Prime Minister, Manmohan Singh accepted a plan outlined by C. N. R. Rao (in 2005), who was then Chairman of the Scientific Advisory Council, Government of India (GoI). Rao had always held that research in basic sciences is an essential ingredient for developing countries[1].

The plan was to set up new institutions – Indian Institute of Science Education and Research (IISER), one each in five different regions, viz. north, south, east, west and central India, under the Ministry of Human Resource Development, GoI. Without delay, the first two, IISER Kolkata and IISER Pune were started in 2006 itself, followed by IISER Mohali in 2007, IISER Bhopal and IISER Thiruvananthapuram in 2008. Two more have come up subsequently, one in Tirupati and the other in Berhampur. The financial outlay for each of the institutes was initially Rs 500 crores. This was subsequently revised to Rs 800–900 crores. It was decided to admit 200 students yearly in each of the IISERs at the BS–MS level, and a similar number at the doctoral level.

Ten years after the first IISERs were set up, Directors of the first five IISERs took stock of the situation, recorded the trials and tribulations they faced, and indicated some lessons learnt. They noted with satisfaction that the experiment in institution-building has been well-received. The book under review, compiled and edited by N. Sathyamurthy (former Director IISER Mohali) and R. Bandyopadhyay (Humanities and Social Sciences, IISER Mohali) reflects these deliberations. It is a remarkably frank document that provides many fundamental ideas, which have the potential to transform the state of higher education in the country, even as its focus is on strengthening the topmost layer of the sector. The document would be of great relevance in drawing up the country's comprehensive education policy, which is long overdue. The last major contribution in this field was made by the Kothari Commission 50 years ago.

What is special about IISER?

The importance of IISER for any policy review of higher education in science arises from its unique course design and the way it conducts courses. IISERs cannot be equated with IITs or IISc. According to Sushanta Dattagupta (founder Director of IISER Kolkata), it will be an oxymoron to call IISER a science university, since a university should have universality of subjects, not only science or technology.

The objectives of IISERs envisage the creation of world-class institutions for undergraduate and postgraduate education in science, backed by state-of-the-art research.

The main goals are: reversing the declining trend of young people opting for basic research; introduction of interdisciplinary studies; involvement of undergraduates in research activities right from the start; provide for flexibility in the choice of subjects and scope for easy mid-course change of subjects; break of the old mode of viewing subjects like physics, chemistry, mathematics and biology as water-tight compartments and staying with the initial choice made with points of no return; provision of a strong foundation of basic knowledge of a wide range

of disciplines backed by experimental research, and slow and deliberate recruitment of faculty who can synergize research, teaching and education.

The course design of IISERs is an outstanding innovation aimed at a totally new way of addressing the issues in higher education in science in the country (Box 1).

The working of IISERs has proved the cynics wrong. It has provided a refreshing contrast to the negative image of the potential in higher education in India.

Going by the progress reported in the book, several contributory factors for the success of the experiment may be identified: full academic freedom in course planning and implementation with no political interference; adequate funding with minimum oversight; freedom from micro-management of the institutions by outside agencies; proactive and helpful higher layers of State bureaucracy sensitive to the needs of science education; sustained and dedicated hard work of the founding Directors, who have endured the teething troubles of building institutions from the scratch, including the agonizing delay and hurdles in land acquisition, and completion of regular buildings as well as securing the latest laboratory equipment for undergraduate education, and above all, intake of the creamy layer (top 1%) of bright students (who have taken State and Central Board examination and those who have secured high ranks – within 10,000 – in the JEE Advanced examinations; provision of generous scholarships (100% in the early years); admission of girl students (40%); and self-motivated staff of international calibre. The involvement of undergraduates in research has proved a success as evidenced by peer-reviewed research papers showing their participation[2]. In a short period, IISERs have acquired a brand name for excellence in education. In the Nature Index-2018 ranking (publications in top journals), IISERs as a group are placed at the top of Indian institutions. Several IISER graduates have secured coveted research positions abroad.

This raises the question of utilizing the world-class talent at home as well as building a strong science base. The book indicates that IISERs are likely to be called upon to play an increasing role in taking up sponsored projects. IISERs have attracted several such projects worth crores of investment, indicating the high level of confidence of the sponsors in these institutions. Recently, technology business incubators have been set up in some of the IISERs. It is hoped that some ground rules would ensure that the sponsored projects would result in a win–win situation for both IISERs and the sponsors, and avoid potential use of these institutions to serve the vested (commercial) interests of the private sector.

In the long run, as the number of IISER graduates increases, it is hoped that institutions in the country like ISRO, BARC, DRDO and CSIR would make the best use of their talents and experience. There is an ever-present risk of under-utilization of their skills by involving these graduates in the run-of-the-mill projects that have little scope for their creativity.

The authors have made a valuable contribution that is reassuring, as the country undertakes to reform and revitalize the education sector.

Box 1. Unique features of the IISER course design

In the first two years of the five-year BS–MS course of IISER, students study nearly 'everything', including physics, chemistry, biology, mathematics, computer science, and become ready to solve any problem without viewing it as outside their subject. At the end of two years, they choose 'majors' (and electives) irrespective of what they liked earlier and take summer internships along with electives.

Even in the beginning of the third year, students have the flexibility to change their 'major'. They have the opportunity to take up interdisciplinary studies in line with the world trends during the third and fourth years, with strong inputs of research experience gained from internship in other institutions at home and abroad. In the final year, students undertake research at an institution of their choice, including those abroad and submit a thesis (not a project report). The BS–MS degree certificate of some of the IISERs does not mention any specific discipline. In fact, this enables the students to take up any subject of their choice for the post-M Sc–Ph D.

About 50% of the IISER graduates go for higher studies in India or abroad. They can join IITs or IIMs or IAS or teaching. They can also join technical institutions like ISRO and BARC at appropriate levels.

1. Mohan Sundara Rajan, *Science as a Way of Life; A Biography of C.N. R. Rao*, Prism Books Pvt Ltd, 2003.
2. Sathyamurthy, N., *Curr. Sci.*, 2016, **110**(5), 747–748.

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Annual Review of Immunology, 2017. Dan R. Littman and Wayne M. Yokoyama (eds). Annual Reviews, 4139 El Camino Way, P.O. Box 10139, Palo Alto, California 94303-0139, USA. Vol. 35, vii + 572 pages. Price: US$ 112.

The *Annual Review of Immunology* is a yearly compendium that is eagerly awaited. For several years now, its contents have included definitive and exhaustive reviews by leading researchers, more particularly in fields of the immunological sciences which have witnessed signature advances over the last couple of years. This volume is no different. While we review several contributions, we apologise to the authors not cited due to a paucity of space.

Inherent factors affecting susceptibility to inflammatory diseases have become the focus of renewed investigation. Genome-wide association studies using SNP arrays, as well as whole genome sequencing and whole exome sequencing have provided insights into genetic factors that influence the response to vaccination, and that enhance the likelihood of primary immunodeficiency and autoimmune disease. It is interesting, as Langlais *et al*. (pp. 1–30) report, that considerable overlap has been documentted between genes that influence inflammation and those that mediate primary immunodeficiency. Epigenetic profiling of immune-mediated diseases has added another