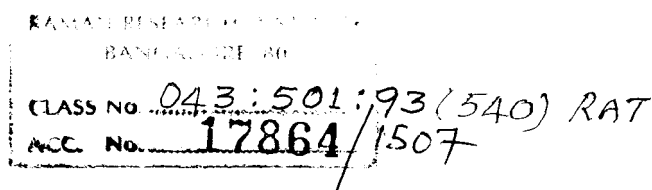


C H A P T E R 3

Entry of Indians Into Scientific Research and The Indian Scientific Journals during 1900-1940

As scientific journals are closely intertwined with Science, they cannot be discussed in isolation. Their growth and **success/failure** have to be viewed vis-a-vis the growth and development of the subject at any particular period. Since there was a tremendous change in the scientific environment in the country during the twentieth century and more so after Independence, we make a brief survey of the development of Science, particularly Physics and Astronomy during that period in the country.

Scientific research had taken roots in the West, especially in Europe in the early nineteenth century. But in India it got organized only in the first three decades of the twentieth century. During this period, seeds for research were laid by a few philanthropists, educationists and scientists who had a nationalistic fervor and commitment to science. The main centre of action was at Calcutta. The Indian



Association for the Cultivation of Science and the University College of Science at Calcutta, both established during the last century nurtured early scientific research in the country.

Sir Asutosh Mookerjee, a judge of the Calcutta High court and Vice Chancellor of the Calcutta University, did much to promote science in the University of Calcutta. Thanks to the generous contributions made by Rash Bihari Ghosh and Tarak Nath Palit, two lawyers of Calcutta, Asutosh Mookerjee could create new chairs like the Palit Professorship and Rash Bihari Endowment to be occupied by eminent Indians.

C.V. Raman and K.S. Krishnan at the Indian Association, S.N.Bose and M.N.Saha at University College, J.C.Bose and P.C.Ray at the same place were the leading personalities who transformed Indian science during this early period. J.C. Ghosh, P.C.Mahalanobis, N.R.Dhar names well known in Indian Science were all at Calcutta during this period. From about 1906 till the 1930's, the Calcutta School of Physics played a significant role in building a research culture in the country.

C.V.Raman, who had taken up the job of Deputy Accountant General in the Finance Department after

passing his M.A examination from Madras University, came across the Association at Calcutta quite by chance. With his deep interest in research work (he had already published scientific papers in leading research journals abroad even as a student at the Presidency College, Madras) he started research at the Association from 1907. This was the beginning of almost a quarter century of intimate connection between **Raman** and the Association. He did research work before and after office hours until 1917 when he gave up his lucrative job at the finance department and accepted the **Palit** Professorship offered by Calcutta University at a lower salary. This indicates his interest in research and commitment to science. The Association which was not very active **till Raman** started working there, became a centre of intense research activity. A number of scholars both from Calcutta and outside joined the centre. Some of the physicists who worked with him were D. **Banerjee**, S. K. **Banerjee**, S. Bhagavantam, A. Ganesan, K.S.Krishnan and K.R.Ramanathan. While working at the Association **Raman** also lectured in Calcutta University where Bose and Saha were teaching. A good school of Physics developed at the University. To quote Raman:

" the Calcutta University can claim to possess a real school of physics, the like of which certainly does not exist in any other Indian University, and which, even now will not compare very unfavourably with those existing in the best European and American Universities" (Raman, 1917).

Raman invited the German physicist Sommerfeld to Calcutta in 1928. Sommerfeld lectured at the University and visited the Association with which he was impressed. He wrote in his diary in German:

" Jeden Morgen lectures 8-10 mit **unzerlegbar** discussion. **Raman, S.N. Bose, D.M. Bose.** Auch Gosh von Dacca gesehen. Im **Institut** scattering **blau-grün** in einem Eis block gesehen; **deutlicher** modified scattering. **A7les im Inst. sehr gut**". (Sommerfeld, 1928) :

" Every morning lectures 8-10 with **simple** discussion. **Raman, S.N. Bose, D.M. Bose.** Also seen Gosh from Dacca. Seen **blue-green** scattering in an ice-block in the **Institute**; **clearly** modified scattering. **Everything is very good in the Institute**".

During the same year S.Chandrasekhar who was just a student at that time and who won the Nobel prize decades later for his work in astrophysics, attracted by the scientific atmosphere prevailing at Calcutta, visited the Association. It is understood that while at the Association he started thinking about stars and his work related to this was presented at the meeting of the Indian Science Congress at Madras in 1929 (Venkata-

raman, 1988). It was during his days at the Association that Raman attracted world wide attention for his work on Acoustics and Optics and, in particular, scattering of light, which led to the discovery of the effect now known by his name (Raman Effect) ; it was in the same period he received many prestigious awards - Fellowship of the Royal Society, the Hughes Medal, Knighthood of the British Government, and to top it all, the coveted Nobel prize in 1930. Raman, as we shall see later believed in publishing our own journals and was instrumental in starting the Bulletin of the Indian Association for Cultivation of Science, Proceedings of the Indian Association for Cultivation of Science, Indian Journal of Physics and later on at Bangalore, the Proceedings of the Indian Academy of Sciences. He was also closely associated with Current Science.

Sathyendranath Bose and Meghnad Saha two other well known physicists of the country were both lecturers at the University College, Calcutta. Bose worked here during 1916-1921, and again from 1945 till he retired in 1956, and Saha from 1916 till 1919, and 1938 to 1953 . Bose came to prominence with his work on Photon Statistics and much later recognising his contributions to the field, certain types of elementary parti-

cles were named after him as "Bosons". He and Saha translated from German to English Einstein's paper of 1916 on the Foundations of General Relativity. He left Calcutta University and joined Dacca University in 1921. He sent two of his papers to Einstein and requested him to give his opinion on them, translate them into German and help get them published in the German periodical Zeitschrift fur Physik. Einstein in fact did comply with Bose's request. Bose returned from Dacca University to Calcutta University in 1945 as Khaira Professor.

Meghnad Saha who taught at the University College, Calcutta till 1919 contributed substantially to physics and astrophysics by his work on "Thermal Ionization". Saha's ionization formula is well known in astrophysics. Kothari writing Saha's Biographical Memoirs for the Royal Society says : "His name would always remain associated with the theory of thermal ionization and its application to the interpretation of stellar spectra" (Kothari, 1966). Saha went to Europe in 1919 and after his return in 1921 worked for a short while at Calcutta. He then joined Allahabad University where he spent a number of years and built a school of physics. He returned to Calcutta in 1938 to occupy the Palit Professorship which Raman had occupied earli-

er. K.S.Krishnan, one of the close associates of Raman at the Indian Association for Cultivation of Science was another leading physicist who worked not only at Calcutta but later on at Dacca University and New Delhi. Two other scientists, J.C.Bose and P.C. Ray, also contributed significantly to Indian science during this period. Though J.C.Bose was interested in Physics and worked on Electric waves and microwave receivers in his earlier days, (he published his paper on microwaves in the Journal of the Asiatic Society in 1896) his interest shifted to Biology after 1900. He founded the Bose Research Institute established in 1917 and published most of his research work in the Transactions of this Institute. P.C. Ray was the leading chemist in the country during that period. Both Bose and Ray taught S.N. Bose and Saha at the university. Thus we see scientific research getting organized on a sound footing at Calcutta under the able guidance of these scientists. Undoubtedly Raman was the central figure in this effort. Raman and Saha were also instrumental in starting scientific journals in the country. They not only started them but also contributed articles to these journals.

The period 1900 - 1930 could be called the "Golden Age" of Physics in the country. As has been mentioned earlier, important discoveries were made during this period (Raman effect, Bose's statistics, Ionization equation of Saha) and the work of the leading scientists were well received outside the country. But the stronghold of Calcutta with respect to physics research slowly declined due to the migration of the top physicists to other cities - with Bose, Saha and Raman going to Dacca, Allahabad and Bangalore respectively. Though Saha and Bose returned to Calcutta after their stints elsewhere, the Calcutta School did not regain its old glory.

Although research activity was gaining grounds in the country, specially in Physics, there was no journal in the country specifically devoted to physics. With the increase of scientific activity at the Indian Association, Raman started the first Indian publication devoted to Physics in 1909. It was the Bulletin of the Indian Association for Cultivation of Science. Till this was started, the research work done by the Calcutta School was reported in foreign journals, excepting for an occasional article in the Journal of the Department of Science of the Calcutta University. The first five numbers of the Bulletin of the Association

were just collection of reprints of the papers published in other journals like Nature, Philosophical Magazine etc. But from Number Six onwards, original articles started appearing in this publication. In all fifteen numbers were brought out till 1918. Some of the important work published by Raman in the Bulletin were on Acoustics and Musical Instruments. Two numbers, No. 11 and No. 15, reported exclusively the work of Raman. In 1917 "Proceedings of the Indian Association for the Cultivation of Science" was started. This publication carried not only research articles but also the papers read at the scientific meetings of the Association and the Annual Report of the Association. In 1926, the Association started the Indian Journal of Physics. It is mentioned in the publication "Century" published by the Association in 1976 to mark its centenary that:

" By 1926, the research activities greatly expanded and consequently it was imperative to make arrangements for regular and prompt publication of research results within the country. As a result, the Indian Journal of Physics made its appearance in the same year with which was incorporated the Proceedings of the Association" (Century, 1976).

But it is not clear why a new title was given as the Proceedings published till then was also continued as a part of the Indian Journal of Physics. Perhaps it was felt by the Association that it would be more

appropriate to publish only scientific papers in a research journal. But as the Association wanted to continue "Proceedings" for other reasons such as publishing the annual report of the work of the Association and matters pertaining to the Association, it was also included in the journal. But Proceedings continued to have its own volume number.

Raman was very much involved in starting the Indian Journal of Physics. He published six papers in the Indian Journal of Physics including his famous paper "A New Radiation" in 1928. Indian Journal of Physics remained largely a channel for publication of the Calcutta School. We should note that research efforts in Physics elsewhere were either non-existent or at a very low key. But when the Bangalore School got organized after Raman moved to that place, its contributions went to the Proceedings of the Indian Academy of Sciences started in 1934.

A study of the publication pattern of Raman, Saha, S.N. Bose and Krishnan during the period 1910-1930 has shown that most of their research findings were published in foreign journals. During the period 1906-1930 Raman published 146 papers in foreign journals.

and 21 in *Indian Journals*; S.N.Bose (1918–1930) 5 in *foreign journals* and 2 in *Indian journals*; Saha (1917–1930) 42 in *foreign journals* and 10 in *Indian journals* and Krishnan (1925–1930) 26 in *foreign journals* and 7 in *Indian*. In addition to journal articles Raman published one monograph on "Molecular Diffraction of Light" in 1922 (Calcutta University Press) and an article on Musical Instruments (translated into German by the publishers Springer Verlag) in Handbuk der Physik in 1927. Table 2 summarizes this information. The break up of the number of articles published by Raman on different topics during this period is shown in Table 3. This trend of publishing predominantly abroad was perhaps due to the fact that the Indian Journals had not taken root and were still in their infancy; the system of circulating preprints/reprints extensively was not yet a common practice. An exception to this was a particular case when Raman mailed a large number of reprints of his article "A new Radiation" published in the Indian Journal of Physics in 1928. He did this to establish priority for his work. It is found that it was the practice Of Raman to send a brief note Of his work to Nature and publish the details Of the work in Indian Journal. This served the dual purpose of making his work known to scientists in other parts of the world (where perhaps there was a better audience for

TABLE 2

**Number of Publications of Raman, Bose, Saha and Krishnan
in Indian and Foreign Journals till 1930**

		Indian	Foreign	Total
Raman	(1906–1930)	21	146	167
Bose	(1918–1930)	2	5	7
Saha	(1917–1930)	10	42	52
Krishnan	(1925–1930)	7	26*	33

*** 20 joint papers with Raman**

TABLE 3
Raman's Publication during 1906-39 on different Topics

	Foreign		Indian	
Wave Optics	27	(1906-1927)	2	(1926-1939)
Colloid State	8	(1909-1927)	1	(1927)
Molecular Scattering of Light	27	(1919-1931)	1	(1928-1931)
	0	(1932 onwards)		(Book)
Raman Effect	13	(1928-1932)	3	(1928-1931)
Magnetism and Electro Optics	15	(1927-1929)	1	(1929)
Optical and Elastic Properties of Solids	9	(1918-1926)	5	(1934-1939)
Ultrasonics and Hypersonics	4	(1935-1938)	5	(1935-1936)
Vibration and Sound	20	(1909-1922)	3	(1914-1922)
Theory of Musical Instruments	12	(1914-1927)	7	(1914-1934)
Viscosity of Liquids and Surface Forces	8	(1907-1928)		-
Line Spectrum	4	(1922-1925)		-

such work) and at the same time nurturing Indian journals to gradually build them up.

In the beginning of the 1930's there arose some conflict between Raman and the authorities of the Indian Association for the Cultivation of Science which eventually led to Raman leaving the Association, and Calcutta and moving over to Bangalore in 1933. It has already been mentioned that Bose, Saha and Krishnan had by now left Calcutta. And when Raman left Calcutta for Bangalore, Fermor, the well known Geologist, addressing the 20th session of the Indian Science Congress in 1933 remarked :

".....Calcutta's loss will be Bangalore's gain. At present Calcutta may be regarded as the centre of scientific research in India; but, with transference to Bangalore of one of her leading investigators, she will have to guard her laurels" (Fermor, 1933).

Due to the foresight and benevolence of the Tatas, one of the leading industrialists and philanthropists of the country, a research institute had been established at Bangalore in 1907 and was called the 'Indian Institute of Science' (popularly called as the 'Tata Institute' even to this day). It started with two main disciplines - Chemistry (applied, general and organic) and Electro Technology and slowly enlarged its

scope. **Raman** was the first Indian to be appointed as the Director. **It** was during **Raman's** stay at the Institute that Physics got a boost. He was responsible for bringing the German Physicist **Max Born** to Bangalore. But unfortunately within a course of four years he ran into administrative problems and had to relinquish the Directorship. He continued to head the Physics department until **1947** when he retired and moved to his own institute (the **Raman Research Institute**).

Soon after coming to Bangalore, **Raman** founded the Indian Academy of Sciences in **1934**. The Academy was formed under much controversy as there was already a move earlier during the Indian Science Congress Session to form a National body of this kind. This suggestion had been agreed upon by a number of scientists including **Raman**. But as things did not move in the direction he had hoped, **Raman** came out of the Committee which had recommended the formation of the National Academy and started another academy calling **it** "The Indian Academy of Sciences". This was very much resented by others and in **1935** a group of scientists which included **Saha** started the National Institute of Sciences of India, having its headquarters in Calcutta. Thus two organizations, each claiming the status of a National Academy were founded within a short time. Though the stated

functions of the two organizations differed, and do so even to date, it is not inconceivable that the starting of the two academies was a direct result of a personal feud in which Raman and Saha were on opposite sides. However, there were a large number of scientists who were Fellows of both the academies (and there are even more today) excepting for Saha who was not a fellow of the Indian Academy.

Raman was the founder president of the Indian Academy and remained so till his demise in 1970. The Academy had 65 Fellows when it commenced its activities and made provision to elect more Fellows from within the country and honorary Fellows from among distinguished scientists abroad (C.V.Raman, 1935). Today (1990) it has 608 Fellows, 45 Honorary Fellows and 35 Young Associates.

The National Institute of Sciences of India was started in 1935 with L.L Fermor as its first President. Saha was closely connected with it and was its second President. It had its headquarters in Calcutta and had the role of a federation for the existing academies and societies in the country. Both the Indian Academy of Sciences and the National Institute brought out their

own "Proceedings". The National Institute moved its headquarters from Calcutta to Delhi in 1945, and its name was changed to "Indian National Science Academy" in 1970.

One of the main objectives of the Indian Academy of Sciences was to publish journals. Since much of the work done in India was getting published outside the country, Raman made a case for Indian journals. He wrote in *Current Science*:

" It is true that individual scientific workers in India have by their indefatigable industry achieved great distinction for themselves, but the prestige of both official and non official research work is still slow in attaining that status of international importance reached by most European countries. This unsatisfactory position is in my opinion partly due to the tendency of many scientific men to export their more important contributions for publication in foreign journals, with a proportionate impoverishment of Indian Archives. Perhaps if the resources of an all India journal such as we contemplate in connection with the Academy of science, had been available for giving Indian scientific work suitable international publicity, the outflow of memoirs from this country would have been more restrained and less voluminous. Continuance of this practice will retard the process of building up a scientific tradition for India and keep her in a position of semi dependence in the world of science. While the foundations of the scientific reputation of a country is established by the quality of work produced in its institutions, the superstructure is reared by the national journals which proclaim their best achievements to the rest of the world " (Raman, 1933).

(Surprisingly as far as Physics was concerned, the existence of such a journal Indian Journal of Physics which Raman himself started seems to have been ignored by him!). With this firm belief, Raman started the Proceedings of the Indian Academy of Sciences in 1934, soon after the Academy was established that year.

The first volume was in one section covering Physical, Mathematical and Biological Sciences. From Volume Two onwards, it was brought out in two sections - Section A covering Physical and Mathematical Sciences and Section B, devoted to Biological Sciences, somewhat on the lines of the Proceedings of the Royal Society (London). Raman edited the Proceedings till his demise. He paid a great deal of attention to its publication on time. During his times the articles used to be communicated by Fellows. After the Proceedings were started Raman published most of his work in it. He published 458 papers in all (during the period 1906-70) out of which 294 were published in Indian Journals. Of these 294 papers, 273 were published during 1931-1970, a majority of them (206 papers) in the Proceedings of the Indian Academy of Sciences during 1935-65.

The Proceedings became a vehicle for the physicists at the Indian Institute of Science, and also for various University departments in the country - specially Andhra University at Waltair, Annamalai University and Aligarh Muslim University. For example, in the first ten volumes there were 180 articles from the Indian Institute of Science (out of 727 articles). The Proceedings gradually gained the attention of scientists outside the country. It had gained sufficient status by 1938 that when the Academy decided to bring out a special issue in that year to commemorate the fiftieth birthday of Raman and ten years of research connected with the Raman Effect, it received articles from physicists in different countries - Brillouin (France), Hans Mueller (M.I.T., U.S.A), Jordan (Germany), Kohlrausch (Graz), Sutherland (Cambridge) and San-Ichiro (Japan), to name a few. Homi Bhabha, the architect of Atomic Energy in the country, patronized the Proceedings. He published thirteen articles in it during the period 1939 - 1951. It is interesting to note that there were very few *articles* from Calcutta, specially from the Indian Association and the University. Perhaps their own publication Indian Journal of Physics was being used by them. Neither Bose nor Saha published in the Proceedings Of the Indian Academy ! Curiously, K.S.Krishnan, an early associate of Raman at the Indian Association at Calcut-

ta, published only three papers in this journal. He published 99 articles (eighty four in foreign journals and 15 in Indian journals (6 in Current Science and three each in Indian Journal of Physics and Proceedings of the Indian Academy of Sciences) during 1931-1961). Saha published 33 articles (20 in Indian and 13 in foreign journals) during the same period. We see Krishnan's clear *preference* for *publishing in foreign journals*.

The starting of the Indian Science Congress (1914) and the journal Current Science (1932) were two other important events connected with Indian Science during this period. The Indian Science Congress Association was, as *it* is even today, a forum for the meeting of scientists from different disciplines working *all* over the country. In the early days (till the Indian Academy and the National Institute were founded), *it* was the main scientific conference in the country. Bhabha, Bose, *Raman* and Saha were the General Presidents of the Congress at one time or other. Jawaharlal Nehru was a regular invitee to this congress and he used to participate with interest in the deliberations. Distinguished scientists from different countries representing their national academies were invited for these meetings.

Scientific papers on current work were presented at different sectional meetings. The Proceedings of the Congress was also brought out regularly, in the early days as a part of the Journal of Asiatic Society of Bengal, and later on by the Science Congress Association itself. Unfortunately, today the Annual meetings have become more of a mass gathering (in thousands) of scientists, with very little scientific outcome. It was during one of the meetings of the Association, that the idea of forming a National Academy was discussed.

In 1931, Dr. Forster, the then Director of the Indian Institute of Science sent a questionnaire to various scientists to get their response for starting a Science News Journal on the lines of "Nature". This matter was discussed in the meeting of the Science Congress in 1932. The idea was well received and the journal "Current Science" was started in July 1932. It was managed by a committee and had the patronage of many leading scientists, the Indian Institute of Science and the Madras University. Raman was associated with this journal from its beginning and was the President of the Current Science Association from 1947 till his demise in 1970. Though the journal was intended to be multi disciplinary in nature, it gradually ended up with a bias towards Biological Sciences. Raman published 65

articles in this journal. This journal was hoped to be a *Letter* Journal for all sciences but as mentioned it was biased towards Biological Sciences. It is still being published regularly and as we will see in a later chapter there have been vigorous attempts in recent times (1989) to revive this journal.

As mentioned earlier, the National Institute of Sciences of India also brought out its own publication - "Proceedings" in two sections. Unlike the Proceedings of the Indian Academy, this included not only research articles but also other material like the papers read at its meetings and Annual Report. Saha contributed half a dozen articles to this journal. But there was no contribution from Raman to this journal. The National Institute also published its Transactions.

In 1935 Saha started another journal Science and Culture. This was not a pure research journal. Saha published in this journal nearly 150 articles on various topics including those pertaining to the problems of India. Another periodical published during this period which is still being continued is the Proceedings of the National Academy of Sciences at Allahabad.

Along with Physics, Astronomy also began to take roots in the country, but at a slower pace. An important centre for astronomical observations was the Kodaikanal Observatory in South India. It was started as a result of the shifting of the Madras Observatory and was established under the Meteorological Department in 1900. The observatory was mainly concerned with solar studies. Evershed, who was the director of the observatory in 1911, contributed to a great extent to research in this field. He is well known for his studies on sunspots and in particular, "radial motion in sun spots" which is known as the "Evershed Effect". Cosmic ray measurements were carried out here in 1940. This observatory brought out a bulletin called the Kodaikanal Observatory Bulletin. The first number of this Bulletin was brought out in 1908. Evershed contributed a number of articles (~20) including his work on the "radial motion in sun spots" to this publication. However he published some of those articles in the Monthly Notices of the Royal Astronomical Society also. Apart from the research articles, the Bulletin contained the data of the solar geomagnetic and ionospheric observations carried out at Kodaikanal. In addition to the Bulletin there was also the Memoirs of the Kodaikanal Observatory of which only one volume was published.

Kodaikanal Observatory was the forerunner of the present Indian Institute of Astrophysics. It is interesting to note that for a short while there was an Astronomical Society during 1910-1916. H.G.Tomkins was its first President and Raman was the secretary for some time. The Society published its journal during this period and was closed down in 1916, perhaps due to the World War (Abhayankar, 1982). Both Raman and Saha took keen interest in the development of astronomical research in the country. Knowing the importance of astronomy Raman wrote in an article in Current Science.

"...the organization of scientific research in India must be considered radically defective unless and until adequate provision is made for astronomical study and research of the highest grade in the country" (Raman,1943).

Saha was the Chairman of a committee which was set up in the early 1950's to estimate the requirements of Astronomical research in the country (Bhattacharyya, 1985).

Thus we see that by 1940 scientific research activity had taken root in the country and was reasonably well established. Scientists like Bhabha, Bose, Krishnan, Raman and Saha had made a name for themselves and Indian science had gained some recognition

outside the country. This situation is very well reflected in Sommerfeld's impression about India. He writes:

" India had a special attraction for me because study shoots of modern physics have sprung up in recent years on this ancient cultural soil and scientific research in India has suddenly begun to compete on equal terms with research in Europe and America. No discovery in Physics during the last year has caused so much excitement and collaboration combined with admiration in the entire world as the spectroscopic effect found by Professor C.V. Raman in Calcutta and developed by him in an exemplary manner; and no discovery in astrophysics has been found to be as fruitful for our understanding of the stellar system as the theory formulated by Saha, at present Professor in Allahabad. The international importance of these two men is borne by the fact that they have been chosen members of the Royal Society in London, that old and venerable Academy of Science" (Sommerfeld, 1929).

Though the scenario of scientific activity in the country was encouraging, it was a different story with regard to the scientific journals. They had not the same recognition that Indian science had. This was perhaps due to the fact that leading scientists published their most important work in foreign journals (specially Krishnan, Saha and to some extent even Raman). Table 4 gives a picture of the number of publications of Raman, S.N.Bose, Saha and Krishnan in some of the well known foreign journals. Table 5 gives the number of publications of these scientists in Indian and

TABLE 4

Number of Publications of Raman, Bose, Saha and Krishnan
in some leading foreign journals

	Raman 1906-45	S.N. Bose 1918-55	Saha 1917-56	Krishnan 1925-61
Nature	83	-	14	47
Proceedings of Royal Society	19	-	1	24
Philosophical Magazine	39	3	15	9
Physical Review	9	-	2	8

TABLE 5

Publication Pattern of Raman, Bose, Saha, Krishnan and Bhabha during different periods

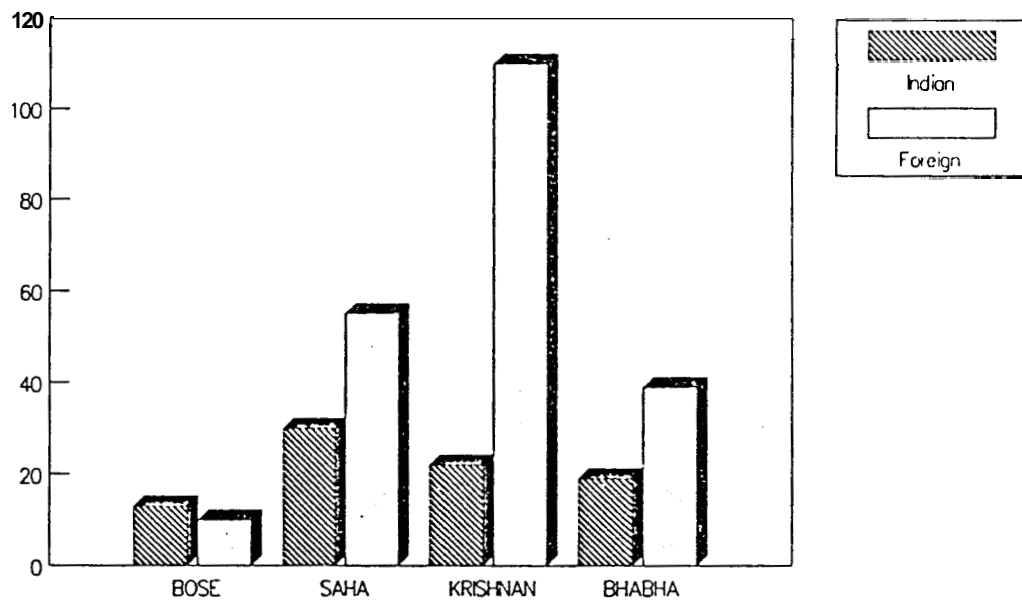
	Foreign	Indian	Total
RAMAN, C.V.			
1906 - 1930	146	21	167
1931 - 1970	18	273	291
TOTAL	164	294	458
BOSE, S.N.			
1918 - 1930	5	2	7
1931 - 1955	5	11	16
TOTAL	10	13	23
SAHA, M.N.			
1917 - 1930	42	10	52
1931 - 1956	13	20	33
TOTAL	55	30	85
KRISHNAN, K.S.			
1925 - 1930	26	7	33
1931 - 1961	84	15	99
TOTAL	110	22	132
BHABHA, H. J.			
1933 - 1954	39	19	58

Source: For Raman: Consolidated list of C.V.Raman's scientific papers published in six volumes by the Indian Academy of Sciences, 1988.

For others: Biographical Memoirs of the Fellows of the Royal Society. V21(1975), V5(1959) and V13(1969)

foreign journals, along with that of Bhabha during different periods. **It** was only after **1940** that **Raman** became an exception and published most of his papers in Indian Journals (see Table 5). Till **1940** only **46** articles were published by him in Indian Journals against **162** in foreign journals ! The total number of articles by Bose, Krishnan, **Raman** and Saha in the Indian Journal of Physics was only **19**. The few good articles published in the country had to be shared among the journals of the three Academies and the Indian Journal of Physics ! This is perhaps one of the reasons **why** most of them could not break ground in the international scene. The Proceedings of the Indian Academy fared better to a certain extent due to the very good articles **it published** during **1935–1945** especially those by **Raman** and Nath. Overall, perhaps the starting of **60** many competing journals worked against the Indian journals getting recognition abroad. In spite of the enlarged scientific community, the journals suffered from lack of continued patronage from leading scientists. What **Raman** wrote in Current Science before founding the Proceedings, remains true even today, this in spite of now having many journals in India. We can spot a trend set already forty years ago by the eminent scientists of the country with regard to publications in foreign journals (see Table 5 and figure 4).

Publication Pattern of some Eminent Indian Scientists in Journals



Publication Pattern of C.V. Raman in Indian & Foreign Journals

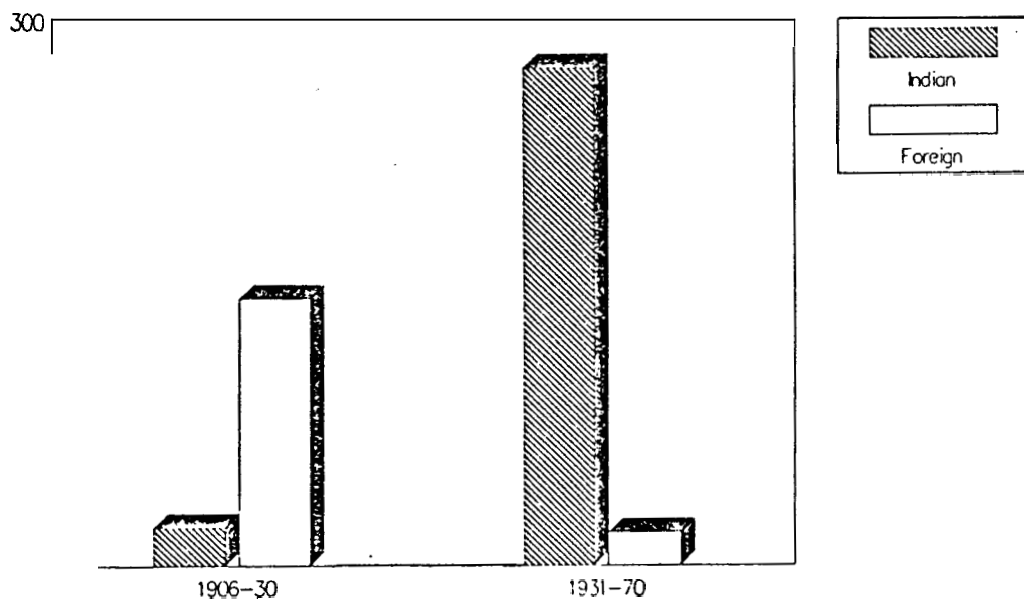


Figure 4

But excepting Krishnan the rest did contribute a reasonable percentage of their papers to Indian Journals. However, as we see in a later chapter the percentage of papers received by Indian journals from well established scientific research centres in the country has dwindled. This is in spite of the serious attempts made by the publishers to improve the standard of the journals.

To summarize, we find that during the period 1900 - 1940, scientific research took roots in the country. A few journals like the Proceedings of the Indian Academy of Sciences and the Indian Journal of Physics published important articles but the majority of the papers from **recognized** Indian scientists (barring to some extent Raman) were published **outside** the country. Not many Indian Journals gained international recognition **inspite** of the recognition Indian science had received abroad.

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