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INDIA'S PHYSICS AND CHEMISTRY NOBEL PRIZE NOMINATORS AND  
NOMINEES IN COLONIAL AND INTERNATIONAL CONTEXT

by

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In India the development of modern science is closely related to its colonial background, a subject well documented by historians. So far as the prestigious Nobel Prizes are concerned, little has been mentioned in the colonial context. This article shows that in the first half of the twentieth century only a few Indian physicists and chemists were either nominees or nominators. Some of them were Fellows of the Royal Society. A comparison of Indian Nobel Prize nominators and nominees with other so-called Third World countries and colonies suggests some interesting results, for example the similarities of development of physics and chemistry in the colonized and ruling countries. The present article also suggests that the election of the Fellows of the Royal Society from India, in the fields of physics and chemistry, reveals a pattern comparable with that of Nobel Prize nominations and nominees.

**Keywords:** Nobel Prize; C. V. Raman; M. N. Saha; H. J. Bhabha; N. R. Dhar;  
P. C. Ray

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INTRODUCTION

The introduction of the western education system in terms of its colonial context has been well documented by historians of the 'Science of Empire'. They have discussed the issue in terms of either the establishment of individual institutions or the impact on single persons who responded to the new system.<sup>1</sup> So far as the Nobel Prizes are concerned, none of the studies has discussed this issue in terms of both the colonial and the international contexts. In 1974 the Royal Swedish Academy of Sciences and its Nobel Committee for Physics and Chemistry instituted a new rule making material available for historical research.<sup>2</sup> In the past three decades several books have been written<sup>3</sup> on the topic, based on the original documents. Little has been said about Indian<sup>4</sup> Nobel Prize nominators and nominees; the present article is intended to fill the gap.

I show that so far as the recognition of Indian work in the fields of physics and chemistry is concerned, there are striking parallels between the Royal Society<sup>5</sup> and the Nobel Committee. To start with, a brief view on the beginning of Indo-Swedish scientific relations is given.

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Finally, a comparative analysis of India's contribution with the so-called Third World countries and Canada (which was a British colony like India) is presented.

#### ESTABLISHING CONTACTS: INDO-GERMAN-SWEDISH AXIS

It is well known that according to the will of Alfred Nobel the five prizes were established for work in the fields of physics, chemistry, medicine or physiology, literature and peace. In the late 1960s the Swedish Bank introduced the Nobel Prize for economics. The prizes are awarded by different institutions.<sup>6</sup> Studies have shown that the prize adjudication can be influenced either by the members of the committee or by Swedish national and international relations.<sup>7</sup> India became an independent state in 1947; before that she had little chance to influence Indo-Swedish relations. Indian men of science adopted a different strategy by initiating personal contacts with Scandinavian scientists.

In the 1920s the work of M. N. Saha, S. N. Bose, C. V. Raman and other Indian physicists attracted the attention of western scientists. It was during this period that terms such as the Saha ionization equation (also known as the Saha-Eggert ionization equation), Bose-Einstein statistics and the Raman effect were coined. The Royal Society rewarded these physicists by electing them as Fellows,<sup>8</sup> though for Satyendra Nath Bose election followed in 1958. J. C. Bose made his name by inventing an apparatus for measuring the short electromagnetic rays in the range 5–6 mm.<sup>9</sup> Later he turned to plant physiology. His theories were rather disputed by his contemporaries. In 1920 he was elected a Fellow of the Royal Society. While in England on 30 August 1920 he wrote a letter to the Swede Svante Arrhenius, one of the most influential members of the Nobel Committee, in which he expressed his wish to deliver two lectures: one before the Society of Physicians and the other before the Academy of Sciences. In another letter of 6 September 1920 he sent the titles of the lectures as 'On the unity of physiological response in plants and animals' and 'On growth and tropic movements in plants'. Bose was duly invited. As to be expected, Bose gave positive views about his host as follows: 'Need I say how deeply I feel the kindness, which I received, in the fullest measure at Stockholm? I came as a stranger but left the country with friendships, which will endure, to the end.'<sup>10</sup>

In the same letter of 24 October 1920 Bose wrote:

I can not thank you enough for your advice to visit Berlin. As my work was of a novel character and depended on experimental demonstration for general acceptance, it was absolutely necessary to have this opportunity in Germany. Professor [Gottlieb Johann Friedrich] Haberlandt who is the greatest living authority in plant-physiology kindly arranged for a meeting of leading scientific men of Germany. You will be pleased to learn that my lecture and demonstration was received with the highest appreciation.

From the foregoing it is clear that Bose visited Germany as suggested by Arrhenius. Behind this suggestion was a political motive, as we shall see below.

#### *Isolation of the German scientific community and the role of Swedish men of science*

After World War I the German scientific community was excluded from international conferences. The author Helge Kragh made the following statement about the discrimination against German scientists:

From 1919 to about 1928, German science was subjected to an international boycott, in the sense that German scientists were not allowed to attend many international conferences. During the early years the boycott was fairly effective, with exclusion of Germans from most international conferences; among 275 international scientific conferences between 1919 and 1925, 165 were without German participation.<sup>11</sup>

The situation was even more dramatic in 1919 and 1920, because the number of boycotted conferences was 100%, compared with about 80% in subsequent years.<sup>12</sup> Kragh further tells us that Scandinavia did not follow the boycott completely.<sup>13</sup> In his discussion of the Nobel Prizes of World War I, J. L. Heilbron mentions that Swedish scientists usually took part of their training in Germany and were therefore inclined to favour that country.<sup>14</sup> Arrhenius's suggestion to Bose to visit Berlin was part of the same story.

The appearance of a scientist from the British Empire must have been a welcome opportunity for an isolated scientist such as Haberlandt, who after Bose's lecture observed, 'We Germans feel ourselves to be allied in this spirit with the Indian people.'<sup>15</sup> In the following years Germany duly took interest in Bose's activities. For instance, in 1926 Bose began his 'seventh scientific mission to Europe'.<sup>16</sup> Before that German authorities had been observing Bose's activities. On 10 December 1925 the German Consulate for British India and the Ceylon colony wrote to the Ministry of External Affairs in Berlin that, according to the press, Sir J. C. Bose had been invited by the Committee of Intellectual Co-operation of the League of Nations at Geneva and that he intended to go to Europe at the beginning of the next year. In the letter it was also stated that Bose had often appeared publicly, and was well recognized and supported by the Indian (colonial) Government.<sup>17</sup>

On 19 January 1926 the Ministry of External Affairs in Berlin wrote a letter to its embassy in London, as is evident from the reply of 26 January. It was interested to know Bose's views about Germany and the Committee of Intellectual Co-operation of the League of Nations. The London office could not give any more information than that sent by its consul in Calcutta. However, in a letter dated 30 January the German Consulate in Geneva sent a detailed report about the planned visit, but was unable to say anything about Bose's views on Germany and the League of Nations. Bose was duly invited. A letter dated 30 September shows that he turned down the invitation because of his inability to visit Germany. In 1928 he came to Munich and delivered a series of lectures.<sup>18</sup>

The foregoing discussion shows that Bose was seen as an important person in a political sense. So far as the Nobel Prizes were concerned, neither the German nor the Swedish communities attached great importance to his scientific work.

## PHYSICS AND CHEMISTRY NOBEL PRIZES IN THE INDIAN CONTEXT

### *Nominators and nominees for the Nobel Prize for Physics*

Bose's contemporary C. V. Raman followed a different path. To establish contact outside the British Empire he sent one of his students, B. B. Ray, to work in the laboratories of Manne Siegbahn (Stockholm) and Niels Bohr (Denmark).<sup>19</sup> It is well documented that he very carefully prepared the road to the Nobel Prize.<sup>20</sup> In 1928 C. V. Raman and K. S. Krishnan<sup>21</sup> made a discovery that later came to be known as the Raman effect,<sup>22</sup> according to which the frequency of monochromatic light changes after it is scattered by a transparent medium. From the analysis of the change in frequency, one can determine the molecular structure of substances. For the discovery of the Raman effect and for his work on light scattering, Raman was awarded the Nobel Prize for Physics in 1930.

For his 1930 prize, Raman's colleagues D. M. Bose (J. C. Bose's nephew) and S. K. Mitra had been asked to send proposals in 1929. In a joint letter they nominated M. N. Saha (see table 1).

From table 1 we see the following.

Table 1. India's nominators and nominees for the Nobel Prize for Physics between 1901 and 1950.

Nobel Prize for the year	nominator(s)	nominee(s)
1929	<b>C. Fabry</b> Niels Bohr	J. Cabanes and C. V. Raman R. W. Wood or Wood and Raman
1930	<b>F. L. de Broglie, H. M. de Broglie, R. Pfeiffer, J. Stark,</b> <i>E. Rutherford, C. T. R. Wilson, N. Bohr, J. Perrin,</i> <b>E. Bloch, O. Chwolson</b> <sup>46</sup>	<b>C. V. Raman</b>
1930	D. M. Bose, S. K. Mitra <sup>47</sup>	M. N. Saha
1934	C. V. Raman <sup>48</sup>	O. Stern
1937	A. H. Compton <sup>49</sup>	M. N. Saha <sup>50</sup>
1938	C. V. Raman <sup>51</sup>	<b>E. Fermi</b> and E. Lawrence
1939	C. V. Raman <sup>52</sup>	<b>E. Lawrence</b>
1939	S. K. Mitra <sup>53</sup>	M. N. Saha
1940	A. H. Compton <sup>54</sup>	E. Lawrence, Saha, O. Stern, O. Hahn, L. Meitner <sup>55</sup>

The nominators in bold are from France. Those in italics suggested that Raman alone should receive the Nobel Prize. The nominees in bold were awarded the prize in the respective year.

- (i) Only two Indian FRS physicists, namely M. N. Saha and C. V. Raman, were nominated for the Nobel Prize for Physics in the first half of the twentieth century. As mentioned above, Raman received the prize in 1930. He was the first Asian and first 'non-white' to achieve this honour. So far he remains the only Indian Nobel laureate. The Nobel Committee evaluated Saha's work. It was not considered worthy of a Nobel Prize. The details of Saha and Raman's Nobel Prize stories are explored elsewhere.<sup>23</sup>
- (ii) Indians received more support from French scientists than from those of any other European country. One of the reasons was that France had a strong group of physicists working on light scattering. They understood and valued Raman's discovery better than others.
- (iii) From the German-speaking area, J. Stark and R. Pfeiffer supported Raman for the Nobel Prize for Physics. They were of the opinion that Raman alone should get the Nobel Prize.
- (iv) How many times C. V. Raman was asked to send proposals between the years 1931 and 1937 remains unclear, because 'the Nobel archive does not have lists of people invited to nominate for the years between 1930 and 1937' (Maria Asp Romefors, Archivist, Center for History of Science, Stockholm; private communication dated 4 April 2007). Table 1 shows that at least once Raman nominated a candidate. Further, according to the communication, the Nobel Archive does have lists of candidates who were asked to send proposals between the years 1938 and 1951. Raman is listed under the category of previous laureates. Table 1 and the published record leave no doubt that during this period he sent proposals only twice. Out of three proposals two of his candidates were successful. His first candidate, O. Stern, was deservedly awarded the prize in 1944.<sup>24</sup> Raman did not nominate Indians because he judged that they had no chance; the history of Nobel Prizes shows that his judgement was correct.
- (v) In general, Calcutta-based physicists supported Saha, but he did not receive heavy international support. The American physicist A. H. Compton was the only person to nominate him more than once. The reason behind the story was Compton's close and private contact in India: his sister was working as a missionary in India. Compton made use of a scholarship to do research in India during 1926–27 and to meet his sister. During

his stay he contacted many Indian scientists. One of them was Saha,<sup>25</sup> with whom his relation lasted for a long time. In 1953, on Saha's 60th birthday, he sent a message and disclosed his nomination for the Nobel Prize in the following words:

It is a pleasure to have the opportunity of congratulating you on the occasion of your sixtieth birthday for your outstanding achievements, especially in the field of thermodynamics. As you may know, I at one time had the honour of nominating you for the Nobel Prize for your work in this area.<sup>26</sup>

- (vi) The Royal Society elected Indians because of the high quality of their scientific work. This is supported by the fact that out of six Indian FRS physicists (H. J. Bhabha, J. C. Bose, Subrahmanyan Chandrasekhar, K. S. Krishnan, C. V. Raman and M. N. Saha) who were elected in the first half of the twentieth century, four were nominated for the Nobel Prize for Physics. Raman and his nephew Subrahmanyan Chandrasekhar received the award; however, the latter was an American citizen. H. J. Bhabha was nominated in the second half of the twentieth century.<sup>27</sup>

In comparison with physics, the story of the Nobel Prize for Chemistry is not very encouraging, as we shall see below.

*Nobel Prizes for Chemistry and Indian nominators: the Indo-Swedish 'chemistry connection'*

We have seen above that in the 1920s Indian physicists started appearing on the world stage. With regard to the history of chemistry, P. C. Ray was the first Indian to make his name in the field of modern chemistry. Others such as J. N. Mukherjee, S. S. Bhatnagar, B. K. Singh, J. C. Ghosh and N. R. Dhar followed later. Based on the model of the Chemical Society of London, the Indian Chemical Society was founded on 9 May 1924, with P. C. Ray as its first President. The Vice-Presidents of the Society were G. J. Fowler, J. L. Simonsen and E. R. Watson. P. C. Mitter and Dhar were Treasurer and Editor, respectively. Among many others, Bhatnagar, Singh and Ghosh were members of the council.<sup>28</sup> Until 1950 Bhatnagar remained the only Indian chemist to be elected FRS. The low representation of Indian chemists on the list of Royal Society Fellows shows a striking parallel with the Nobel Prize for Chemistry.

P. C. Ray studied at the University of Edinburgh. He promoted chemical research and chemical industry in India. In 1902 he wrote *History of Hindu chemistry*.<sup>29</sup> It is in this connection that on 13 March 1913 he wrote a letter to Svante Arrhenius. In part the letter reads:

I am glad to find that your honoured name heads the list of the 'comité de Patronage' of 'Isis', in which I have the privilege to represent India. As you are evidently interested in the History of science, I take the liberty to send you my 'History of Hindu Chemistry'—2 vols. It will perhaps interest you to know that in ancient India chemistry was pursued with zeal and enthusiasm.

In the same letter Ray sent reprints of his papers and mentioned his discovery of mercurous nitrite in 1895.

Ray wrote his last undated letter to Arrhenius in January 1919. In it he asked whether J. C. Ghosh (one of Ray's students) could work in Arrhenius's laboratory. Ray also wrote:

While a student at Edinburgh, now more than thirty-five years ago, ... I dreamt a dream that, God willing, a time would come when my countrymen would, shake off the slumbers of ages and take to the pursuit of Physical Science. If you take the trouble to look to pp-302 etcq., you will find a complete list of contributions by myself and my pupils, amounting to close upon two hundred. I hope a beginning has been made of an Indian School of Chemistry.

Table 2. India's Nobel Prize for Chemistry nominators between 1901 and 1950.

Nominator	Nobel Prize for the year	nominee
P. C. Mitter (Calcutta)	1935	P. Karrer (Swiss)
P. C. Ray (Calcutta)	1935	P. Karrer (Swiss)
N. R. Dhar (Allahabad)	1939	G. Urbain (French), G. Bredig (German)
N. R. Dhar (Allahabad)	1947	P. Walden or L. Meitner (German)
B. K. Singh (Allahabad)	1947	J. R. Geigy and P. Lauser (Swiss)

For 1939 Dhar nominated Urbain, who died in November of that year. Bredig was then proposed.

Whether Ray was speculating on support for the Nobel Prize from Arrhenius is difficult to say. After this letter the communication broke off. Arrhenius remained on the Committee until his death in 1927.<sup>30</sup> It was not until 1934 that Ray was asked to make a nomination (see table 2). In a short letter he replied:

I have much pleasure in recommending that the Nobel Prize in Chemistry for 1935 be awarded to Prof. P. Karrer [Swiss Biochemist] of Zurich for his work on Plant pigments and Vitamin A.<sup>31</sup>

In the same year, 1934, another Indian chemist, Prafulla Chandra Mitter, sent the same proposal as Ray.<sup>32</sup> They were not successful. It was only in 1937 that their candidate, Paul Karrer, shared the Nobel Prize in Chemistry with Walther N. Haworth.<sup>33</sup>

Another Indian nominator was N. R. Dhar, a soil specialist. According to Indian historian Anjana Chattopadhyay, the author of *Biographical dictionary of Indian scientists*, 'Professor Dhar was the founder of physical chemistry in India.'<sup>34</sup> In a six-page document he argued in favour of his candidate Georges Urbain, from France. In conclusion, Dhar tried to touch the sentiments of his Swedish colleagues as follows:

It is in the fitness of things that the land of Berzelius, which has been so fruitful in first rate discoveries in the realm of science, should honour the great land of Lavoisier by honouring its great son Prof. G. Urbain by awarding a Nobel Prize in Chemistry. The two great nations (Scandinavian and French) have worked shoulder to shoulder in the development of rare earth chemistry and it is remarkable that there is an opportunity for one nation to recognise the work of a sister nation labouring in the same field. So far no Nobel Prize has been awarded to any worker in rare earth chemistry and it may be considered whether a prize can be awarded to the most distinguished worker on this subject.<sup>35</sup>

Dhar's letter of 12 December 1938 shows that G. Urbain died in November of that year. He made a new proposal in favour of Georg Bredig, professor of chemistry at the Technical University of Karlsruhe (Germany). About the importance of the work of his nominee he wrote:

He [Urbain] has done excellent work in different branches of physical chemistry, specially electrical conductivity of bases and salts, Inorganic ferment, catalysis, asymmetric synthesis etc. His work on inorganic ferments is really the beginning of systematic colloid chemistry and is of a great importance to the development of the subject and that of enzyme chemistry. As Nobel Prizes in Chemistry have been already been awarded to Professor Svedberg and the late Professor Zsigmondy, two eminent workers in Colloid Chemistry, it seems desirable that the prize should also be given to Professor G. Bredig for his pioneering work in this line.<sup>36</sup>

Bredig did not receive the Nobel Prize. About eight years later, Dhar got the next chance to nominate. On 12 November 1946 he argued in favour of German chemist Paul Walden for his work in electrochemistry and the physical properties of solutions, especially the non-aqueous type. In the last paragraph he suggested Lise Meitner as an alternative candidate:

If for any technical grounds the prize cannot be awarded to Prof. P. Walden, I recommend that the prize may kindly be awarded to Dr. ... Lise Meitner for her very important contributions in atomic disintegration in particular and atomic physics in general. On several occasions when in Berlin I visited the Kaiser Wilhelm Laboratory Dahlem (Berlin) and got to know her work.<sup>37</sup>

The only recommendation not made by a Bengal-based chemist was that of Bawa Kartar Singh, who taught chemistry at the University of Allahabad. At the time of the recommendation, he was an Honorary Professor of Organic Chemistry and Associate Director at the Punjab University in Lahore. Bawa, a specialist in stereochemistry, wrote in the recommendation letter:

I recommend that the prize be awarded jointly to J. R. Geigy S.A. of Basel, Switzerland (Swiss Dyestuffs Company) and P. Lauger for their intensive researches which led to the discovery of the insecticidal activity of D.D.T.<sup>38</sup>

In the letter he mentioned the importance of the chemical as a powerful weapon against diseases conveyed by insects and bacteria.

From [table 2](#) we see that Indian chemists received five invitations and they proposed European scientists, in particular from the German-speaking area. To understand this, one needs to go back to Indo-German political relations. During and after World War I, German authorities started supporting Indian students. Several organizations came into existence in Berlin and Munich. The Deutsche Akademie Munchen started to grant scholarships to Indian students. According to documents in 1930–31 the Akademie awarded nine scholarships.<sup>39</sup> Out of nine, six went to Bengalis. In 1931–32 eight Bengal-based students received the benefit, whereas ten were from other Indian states. Apart from that, it is well known that Ray was anti-British.

Another interesting observation is that most of the nominees were either from Calcutta or connected with Calcutta. It emphasizes the fact that Bengal, in particular Calcutta, was the intellectual centre of India. This is not surprising because most of the organizations based on western education began there.

### NOBEL PRIZES IN THIRD WORLD COUNTRIES AND THE COLONIAL CONTEXT

Between 1901 and 1950 a total of 4357 nominations were made in the two fields.<sup>40</sup> Thirty-three countries had either nominators or nominees. Most of them were either Europeans (including Russians) or from the USA.<sup>41</sup> The nine ‘outsiders’ were Argentina, Australia, Brazil, Canada, India, Japan, Peru, South Africa and Uruguay.<sup>42</sup> With the exception of Japan (which neither was a British colony nor belonged to the so-called Third World countries), the nominators and nominees from these countries are listed in [table 3](#). The Indian case has been given in previous tables.

#### *The Third World comparison*

[Tables 3 and 4](#) show clearly that, like India, other ‘Third World countries’ started appearing in the records of the Nobel Committee from 1930 onwards.

Table 3. Nobel Prizes for Physics, 1901–50.

Year	nominee	countries	nominator	country
1907	E. Rutherford	Canada <sup>56</sup>	seven scientists <sup>57</sup>	Germany
1935	J. C. McLennan	Canada	D. A. Keys	Canada
	P. Langevin	France	L. V. King	Canada
1943	S. E. de Mayolo	Peru	C. Granda	Peru
1944	P. M. S. Blackett	UK	R. W. James	South Africa
1945	O. Hahn, F. Strassmann	Germany	C. Ouellet	Canada
1946	A. J. Dempster	USA	L. Gilchrist	Canada
1947	D. W. Kerst	USA	C. Chagas	Brazil
1949	G. P. S. Occhialine, C. F. Powell, H. A. Bethe	UK, USA	F. Bonnenfant	Canada
	H. A. Bethe	USA	C. Geoffrion	Canada
	B. Rossi	USA	C. Fremont	Canada
	B. Rossi	USA	G. Hall	Canada
	B. Rossi	USA	E. Persico	Canada
	G. P. S. Occhialine, C. F. Powell, A. C. O. Nier	UK, USA	J. L. Kervin	Canada
	E. Gardner, C. M. G. Lattes	USA, Brazil	W. S. Hill	Uruguay
	G. P. S. Occhialine, C. F. Powell, C. M. G. Lattes	UK, Brazil	J. H. Bartlett	USA

Data are taken from E. Crawford (2002).<sup>1</sup> The details for each year are to be found under the relevant years. None of the nominees were awarded the prize in the respective years. Rutherford and Hahn were awarded the Nobel Prize for Chemistry in 1908 and 1944, respectively. Blackett, Powell and Bethe received the Nobel Prize for Physics in 1948, 1950 and 1967, respectively.<sup>58</sup>

Table 4. Nobel Prize for Chemistry nominators or nominees outside the periphery.

Year	nominee	country	nominator	country
1907	E. Rutherford	Canada	S. Arrhenius	Sweden
1930	H. Le Châtelier	France	H. Damianowich	Argentina
1933	R. Robinson	UK	J. C. Earl	Australia
1935	C. G. Fink	USA	H. Hibbert	Canada
1937	L. Ruzicka	Switzerland	J. Risi	Canada
1938	R. Robinson	UK	A. K. Macbeth	Canada
1941	D. D. van Slyke	USA	C. C. Benson	Canada
	J. H. Northrop	USA	H. O. L. Fischer, A. Hunter	Canada
1945	J. H. Northrop	USA	H. O. L. Fischer, A. Hunter	Canada
	R. R. William	USA	C. C. Benson	Canada
1947	T. Reichstein	Switzerland	B. A. Houssay	Argentina
1949	A. R. Todd	UK	A. K. Macbeth	Australia
	T. Reichstein	Switzerland	B. A. Houssay	Argentina
	G. T. Seaborg	USA	G. Villar	Uruguay
	D. Giribaldo	Uruguay	four scientists <sup>59</sup>	Uruguay
1950	L. Pauling	USA	P. A. Gigère	Canada
	T. Reichstein	Switzerland	B. A. Houssay	Argentina
	C. K. Ingold	UK	R. J. W. Le Fevre	Australia

Data are taken from E. Crawford (2002).<sup>1</sup> Rutherford was awarded the Nobel Prize for Chemistry in 1908 as a citizen of the UK and New Zealand. Ruzicka, Robinson, Seaborg and Pauling were awarded the Nobel Prize for Chemistry in 1939, 1947, 1951 and 1954, respectively.<sup>60</sup>

### *Latin America: little chance*

*Physics.* In a period of 50 years there were only two Latin American nominees, namely S. E. de Mayolo (Peru) and C. M. G. Lattes (Brazil), the latter supported by Uruguay and the USA. Europeans never supported them. South Americans sent three proposals. Only the Peruvian C. Granda supported his countryman de Mayolo. In total they had three nominations.

*Chemistry.* The only Latin American countries that ever participated in the Nobel Prizes for Chemistry were Argentina and Uruguay. Argentina had four chances to send proposals. All the nominations went in favour of Europeans. D. Giribaldo (Uruguay) remained the isolated hero of South America, with four proposals in his favour by his countrymen. Neither North Americans nor Europeans supported Latin American candidates.

From the foregoing we see that Latin America had two nominations for physics and one for chemistry. They had little chance because the international scientific community did not give proper support to them.

#### *African continent: no hope*

The worst case is that of the African continent. In the first half of the twentieth century, only once was a nominator asked to send a proposal.

#### *Asia: The 'winner'*

From the Asian continent only India and Japan (details not explored) were the 'global' players. India was the first country to receive a Nobel Prize for Physics in 1930, whereas Japan occupied second place with a Nobel Prize for the physicist H. Yukawa in 1949.

#### *Nobel Prizes in the colonial context*

As a result of colonialism in one form or another, the Latin Americans were influenced by Spain and Portugal, whereas the British had an impact on Australians, Canadians and Indians. Unlike Britain, France and Germany, in previous centuries Spain and Portugal were never major centres of science and technology. This development is further reflected in terms of Nobel Prizes. For Nobel Prizes in Physics, Spain had only six nominators in 1910 and one in 1946, with two chemistry nominations in 1935.<sup>43</sup> Portugal had only three nominations in chemistry in the year 1939.<sup>44</sup> This contribution is negligible compared with that of France and the UK, which had 48 and 26 nominators, respectively, in the field of physics between 1901 and 1929. In the field of chemistry these countries had 41 and 23 nominators, respectively.<sup>45</sup>

#### *Physics*

The Australians had three nominators only in the field of chemistry. They took no part in the area of physics (see [tables 3 and 4](#)). Until 1947 Canada had four nominations, while India had six. Only once did a Canadian nominate a countryman, whereas half of the Indian proposals were in favour of Indians.

In the history of Canadian Nobel Prizes, 1949 seems to be very special because in that year six nominators were asked to send proposals. They nominated five candidates, but none from Canada.

#### *Chemistry*

From 1930 onwards eight Canadians sent proposals, whereas six proposals were submitted from India. Like the Indians, the Canadian nominators sent their proposals in favour of others and neglected their own countrymen.

Canadian and Indian nominators favoured North American nominees. In spite of close political bonds they rarely nominated a scientist from the UK. At the same time, British scientists did not nominate their colonial colleagues. E. Rutherford and C. T. R. Wilson were exceptions, nominating C. V. Raman.

## CONCLUSIONS

Indo-Swedish scientific contact started in the third decade of the twentieth century. The Swede Arrhenius tried to establish Indo-German contact by suggesting that Indian men of science such as J. C. Bose should visit Germany. It reconfirms the conclusion of other historians that Arrhenius had sympathy for the German scientific community, which had been internationally boycotted after World War I. However, here enters a new issue in scientific history, namely the triple-axis relation: the Indian–German–Swedish connection. This proved to be rewarding for Indian physicists because it helped them to exchange views and strengthen bonds.

During the first half of the twentieth century, more Indian physicists than chemists were recognized by their elections to Fellowship of the Royal Society. The first two Nobel Prize nominees, C. V. Raman and M. N. Saha, were elected FRS before they were considered for the Nobel Prize. The case of H. J. Bhabha (not considered here) was no different. The extent to which the Nobel Committee considered Fellowship of the Royal Society as an important recognition for an Indian scientist cannot be definitely ascertained. The fact remains that the Royal Society recognized the work of Indian scientists before the Nobel Committee. It also suggests that the recognition of scientific work by a learned society might have a role in nomination for the Nobel Prize.

It is well known that the ‘Nobel community’—that is, the number of Nobel laureates—is small. The election and nomination processes can be influenced by various factors, such as an individual’s merit and national interests. These issues are not considered here; apart from that, this article is based on very limited statistical data. Thus, the conclusions cannot be seen as general. However, for any study we set up conditions and scales for evaluation. In my case I have considered the Nobel Prizes in Physics and Chemistry. On the basis of this ‘scale’ it can be concluded that the development of physics and chemistry in India presents a better picture than that of any other so-called Third World country. It is even comparable to that of European countries such as Portugal and Spain, or a developed country such as Japan. The reasons behind this ‘success’ story seem to be the establishment of a colonial education system during the previous centuries and also partly the existence of the Indian elite, which supported the system for various reasons. They learnt the rules of the international game of science and its recognition. Raman was most successful in this game. He came from a family background that for centuries (even before the advent of western Europeans) had dominated the education system in India. Apart from that, India had a culture of science and technology that was modified according to the needs of the time.

The present study also throws light on the nomination behaviour of colonialists and their ‘objective’ scientists. In spite of close political bonds, only in rare cases were colonial candidates supported. British scientists nominated either other Europeans or their own countrymen. In contrast, colonial scientists, in particular South Americans, proposed candidates from a ‘neutral country’, the USA.

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## NOTES

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- 2 See E. Crawford, *The beginning of the Nobel Institution—the science prizes, 1901–1915* (Cambridge University Press, 1987), note 2, p. 2.
- 3 H. Zuckerman, *Scientific elite: Nobel laureates in the United States* (The Free Press, New York, 1977); G. Küppers, P. Weingart and N. Ulitzka, *Die Nobelpreise in Physik und Chemie 1901–1929, Materialien zum Nominierungsprozess* (B. K. Blitz-Druck, Bielefeld, 1982); E. Crawford, *op. cit.* (note 2); H. Nielsen and K. Nielsen (eds), *Neighbouring Nobel: the history of thirteen Danish Nobel Prizes* (Aarhus University Press, 2001); R. M. Friedman, *The politics of excellence—behind the Nobel Prize science* (A. W. H. Freeman, New York, 2001); E. Crawford, *Historical studies in the Nobel archives—the prizes in science and medicine* (Universal Academy Press, Inc., Tokyo, 2002); E. Crawford, *The Nobel population 1901–1950—a census of the nominators and nominees for the prizes in physics and chemistry* (Universal Academy Press, Tokyo, 2002); see also E. Crawford, 'The benefits of the Nobel prizes', in *Science in Sweden—the Royal Swedish Academy of Sciences 1739–1989* (ed. T. Frängsmyr), pp. 227–248 (Science History Publications, Sagamore Beach, MA, 1989).
- 4 Here the term 'Indian' is defined according to the citation of the Nobel Prize documents. For instance, Indian-born Subrahmanyan Chandrasekhar FRS (physics Nobel laureate) has been cited as an American citizen.
- 5 For the history of Indian FFRS see J. C. Chaudhuri, *Indian Fellows of the Royal Society and others* (Academic Publishers, Calcutta, 1992), pp. 62–148.
- 6 For the process of nomination, see <http://nobelprize.org/nomination/>, dated 29 December 2006. It states: 'Each year the respective Nobel Committees send *individual invitations* to thousands of members of academies, university professors, scientists from numerous countries, previous Nobel Laureates, members of parliamentary assemblies and others, asking them to submit

- candidates for the Nobel Prizes for the coming year. These nominators are chosen in such a way that as many countries and universities as possible are represented over time' [emphasis added]. See also Nielsen and Nielsen (eds), *op. cit.* (note 3), pp. 588–592.
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- 23 R. Singh and F. Riess, 'C. V. Raman, M. N. Saha and the Nobel prize for the year 1930', *Ind. J. Hist. Sci.* **34**, 61–75 (1999); R. Singh and F. Riess, 'M. N. Saha and his two chances for the Nobel prize', *Sci. Cult.* **65**, 146–151 (1999); R. Singh and F. Riess, 'The 1930 Nobel prize for physics: a close decision?', *Notes Rec. R. Soc.* **55**, 267–283 (2001).
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- 25 R. Singh, 'Indo-American relation in political and scientific context in the 1950s—the example of Bernard Peters', *Ind. J. Hist. Sci.* (In the press.)
- 26 Chaudhuri, *op. cit.* (note 5), p. 93.
- 27 Letters dated 15 February 1950, 29 September 1950, 8 October 1952 and 10 October 1954 show that J. Hadamard—a mathematician from the Institut de France—nominated Bhabha for the Nobel Prize.
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40 Crawford, *op. cit.* (note 3), preface.  
41 See Küppers, Weingart and Ulitzka, *op. cit.* (note 3), p. 140.  
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43 Crawford (2002), *op. cit.* (note 3), pp. 45–46, 175 and 291.  
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45 See Küppers, Weingart and Ulitzka, *op. cit.* (note 3), p. 101, Table 2.  
46 For detail see R. Singh and F. Riess, ‘Sir C. V. Raman and the story of the Nobel Prize’, *Curr. Sci.* **75**, 965–971 (1998). Those shown in italics proposed Raman alone for the prize. Niels Bohr repeated his nomination from the year 1929, according to which either R. W. Wood alone or Wood and Raman should be awarded the prize; J. Perrin proposed that either Raman alone or Raman and Heisenberg should share the prize; E. Bloch supported Wood and Raman; O. Chwolson suggested that Raman should receive half and the rest should be divided between the Russian physicists Landsberg and Mandelstam.  
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48 C. V. Raman to the Nobel Committee, letter dated 25 October 1933.  
49 A. H. Compton to the Nobel Committee, letter dated 11 January 1937.  
50 *Ibid.*; Compton wrote to the Nobel Committee, ‘May I suggest that, in my opinion, a Nobel award to Saha in either physics or chemistry would be acceptable to the scientific world.’  
51 C. V. Raman to the Nobel Committee, letter dated 30 December 1937.  
52 C. V. Raman to the Nobel Committee, letter dated 26 November 1938.  
53 S. K. Mitra to the Nobel Committee, letter dated 18 November 1938.  
54 A. H. Compton to the Nobel Committee, letter dated 8 February 1939.  
55 E. Crawford gives the five names nominated by Compton; see Crawford (2002), *op. cit.* (note 3), p. 161. However, according to Compton’s letter dated 8 February 1939 he nominated E. O. Lawrence, M. N. Saha and O. Stern. About Saha’s contributions Compton wrote, ‘Second on my list I should place Professor M. N. Saha of the University of Calcutta, whom I recommended for the Prize two years ago because of his study of the ionisation of stellar atmospheres. Not only has this work been fundamental to much of the recent development in astrophysics, but it has also formed the basis of recent physical studies of the thermodynamics of high temperature ionization.’ In accordance with the rules for the Nobel Prize for the year 1939 Compton should have sent the reply before 31 January 1939. If the Nobel Committee considered the nomination for the year 1940, it had little effect because the prize for the year was reserved.  
56 According to the Nobel Foundation, E. Rutherford was awarded the prize as a citizen of the UK and New Zealand.  
57 Seven German scientists, namely A. von Baeyer, V. Czerny, H. Ebert, E. Fischer, P. Lenard, M. Planck and E. Warburg, nominated E. Rutherford. See Crawford (2002), *op. cit.* (note 3), p. 35.  
58 See [http://nobelprize.org/nobel\\_prizes/physics/laureates/](http://nobelprize.org/nobel_prizes/physics/laureates/) (accessed 18 July 2006).  
59 D. Giribaldo’s nominators were J. Chiarino, M. M. de Menafra, J. Princivalle and J. Saredo; see Crawford (2002), *op. cit.* (note 3), p. 336.  
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