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Research Papers of Acharya Prafulla Chandra Roy: A Bibliometric Study

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Abstract: This study presents bibliometric analysis of the research papers of Acharya Prafulla Chandra Roy. He is one of the scientists who popularized science in India and truly known as the 'Father of Indian Chemistry'. During the period of 1888 to 1936, in a span of 49 years, he contributed 158 research papers in several reputed national and international journals. The analysis of his contributions includes year and periodical distribution of items, their language distribution, and single and multiple authorship. Year-wise distribution of pages authored by Acharya Prafulla Chandra Roy has also been presented as well as his journal preference based on periodical distribution of articles.

Keywords: Bibliographic study, Acharya Prafulla Chandra Roy, Bibliometric research, Chemistry, Citation analysis

1. Introduction

The term bibliometrics is usually applied to the quantitative analysis of publications of any individual, institution or any discipline. For this purpose mathematical and statistical techniques are used to study the documents and to measure the patterns of publications. The subject of bibliometrics was first defined by Pritchard (1996) as "the application of mathematical and statistical methods to books and other media". Reitz (2010) defines the term 'bibliometrics' as the use of mathematical and statistical methods to study and identify patterns in the usage of materials and services within a library or to

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analyze the historical development of a specific body of literature, especially its authorship, publication and use. Prior to the mid-20th century, the quantitative study of bibliographic data and usage was known as statistical bibliography.

Bibliometric study also helps to find out the publication productivity, examines the authorship pattern for publications, identifies the channels of communications used and ascertains the journal and language preference of an author (Mahmood & Rehman, 2009). This paper is an attempt to bibliometrically study research works of Acharya Prafulla Chandra Roy, well-known as the 'Father of Indian Chemistry'.

2. Literature Review

Dealing with quantitative analysis of publications of an individual may involve the biographical study of that person and thus termed as *bio-bibliometrics*. Sin (1999) defined it as a quantitative and analytical method for discovering and establishing functional relationships between biodata and bibliodata elements.
In the field of bio-bibliometrics many studies have been conducted so far. Sangam and Savanur (2006) bibliometrically studied Dr. N. Rudraiah, a well-known personality in the field of applied mathematics. Another notable study in bio-bibliometrics was conducted by Sin (1999). He presented an analysis of the publication productivity, authorship pattern, and channels of communication of a famous Malaysian history scholar Professor Khoo Kay Kim. This study also included Kim's journal preference and language preference. In another study Cardona and Marx (2006) analyzed impact of the works of Vitaly L. Ginzburg, a Nobel Prize winner for physics. The scientific contributions of the most influential Ginzburg's works were analyzed, in particular their impact on recent research.

3. Biographical Sketch of Acharya Prafulla Chandra Roy

The 19th century is regarded as 'Bengal Renaissance', under foreign rule of suppression, estrangement, and restriction on individual freedom. During this period, Prafulla Chandra was born on 2nd August, 1861, in the village Raruli of the Khulna District of the undivided Bengal into a well-educated and cultured family. His father Harish Chandra was a landlord and a man of taste, learning, and liberal views. Prafulla's mother, Bhubanmohini Devi, was also an accomplished lady of enlightened views. With this family background, Prafulla Chandra was initiated into science in his early youth. After completing his matriculation from Albert School in 1879, he enrolled as an FA student in the Metropolitan Institute. He passed FA in 1881 and was admitted to Edinburgh University with the help of the Gilchrist Scholarship. He passed the B.Sc. examination in 1885 and continued to do research. In 1887, he was awarded the D.Sc. degree for his thesis on 'Conjugated Sulphates of Copper Magnesium Group: A Study of Isomorphous Mixtures and Molecular Combinations'. Since this thesis was judged the best in that year, he got the 'Hope Prize' which allowed him to carry on research for one more year.

Prafulla Chandra joined the chemistry department of the Presidency College in 1989 and stayed there for 23 years as a prominent teacher and researcher, publishing a large number of research paper mostly in reputed international journals. With help of Haraprasad Shastri, he published *A History of Hindu Chemistry* from the earliest times to the middle of the seventeenth century A.D. (Vol. I in 1902 and Vol. II in 1909) based on extensive research and by all means an enormous and pioneering work. He founded the Bengal Chemical & Pharmaceutical Works as a modest dream to turn it into a prosperous organization with a nationalistic outlook. During his active period in Presidency College, he authored 85 research papers, mostly in internationally acclaimed scientific journals on science, social issues and topical economic matters. The second phase of Prafulla Chandra's research started in 1916 in a new ambience when he was persuaded to join the newly established post-graduate chemistry department of Calcutta University.

The next 21 years from his joining to retirement in 1937 was also very productive – 72 papers in all. He completed two volumes of his social-biography – *Life and Experiences of a Bengali Chemist* (Vol. I in 1932 and Vol. II in 1937) and authored numerous articles and a few textbooks. He was the founder and President of Indian Chemical Society (1924). He was referred to as 'Father of Indian Chemists' for the nourishment and spiritual leadership he provided in the infancy of Indian chemistry. He was also referred as 'Acharya' for his self-sacrifice, severity, ethical stand and love for the have-nots. Inclusive of the synopsis of his D.Sc. thesis, which is documented in the *Proceedings of the Chemical Society* (Edinburgh), the total number of research publications is 158 till his death on 16th June, 1944.

4. Objectives

The purpose of this study is to:

- determine the year and periodical distribution of his publications;
- determine distribution of pages produced;
- ascertain the journal and language preferences of the author;
- identify the subject areas covered by the works

5. Method

Prof. Anil Bhattacharya (2006) compiled a bibliography of Acharya Prafulla Chandra Roy's published research papers. This compilation is the result of a UGC minor research project and the volume entitled *Research Papers of Acharya Prafulla Chandra Roy – A Complete Collection* is used for this bibliometric study. Various local and international print and online sources were used to compile this bibliography. Of the organizations and learned bodies that offered covert and overt assistance to compile this collection includes Indian Chemical Society, University of Calcutta, The Bengal Chemical and Pharmaceutical Works (BCPW), Presidency College (Kolkata), Indian Association for the Cultivation of Science (IACS), The Asiatic Society of Bengal, Imperial College (London), Chemical Society (UK), Chemical

Society (UK), Chemical Society (Edinburgh), Acharya Prafulla Chandra Smarak Samity, Sir P. C. Roy Museum (Department of Chemistry, University of Calcutta). MS Excel was used for data recording and analysis. For the purpose of this study, publications of a general nature like condolence messages, etc. have not been included.

6. Findings

During the period of 1888 to 1936, Acharya Prafulla Chandra Roy contributed 158 research papers in several reputed national and international journals (Appendix A).

Acharya Prafulla Chandra Roy started writing on different aspects of chemistry in 1888 when he was 27 years old and in a span of 49 years he contributed 158 research papers. He continued to write research articles till 1936 with yearly gaps in between. Data analysis of Appendix B reveals that despite his old age and bad health in last few years, he produced much more than in his early life. The highest number of publications appeared in 1912 when he was 51 years old. This year he contributed 16 research publications. The first 25% of his publications were produced in 21 years, the second 25% of his publications were produced in next 6 years, whereas in next 22 years of his life he contributed about 50% of all research publications. In the first half of the period studied, he produced almost 44.3% of his entire body of work.
Table 1 shows the language distribution of his publications. Though he wrote in German language, most of his publications were in English; 146 publications (92.41%) were in English while only 12 items (7.59%) were written in German.

Table 1: Language distribution of research papers

Language	**English**	**German**
No. of paper	146	12
Percentage	92.41	7.59

Analysis of Acharya Prafulla Chandra Roy's co-authorship and collaboration was also done (Table 2). He collaborated with another author for 68 publications (43.04%) and with two authors for 19 publications (12.03%). He wrote 71 publications (44.93%) as single author.

Table 2 Authorship distribution of research papers

Pattern of Authorship	**Single**	**Double**	**Triple**
No. of paper	71	68	19

Percentage	44.93	43.04	12.03

Appendix C shows that 38 associates are recorded as joint authors of 87 papers (55.07%) of Prafulla Chandra. Prominent among them with three or more papers are Jitendra Nath Rakshit (10); Kshitish Chandra Boseroy; Nadiabehari Adhikary (8); Nripendra Nath Ghosh (5); Prafulla Chandra Guha (4); Atul Chandra Ganguli (3); Nil Ratan Dhar (3); Manik Lal De (3); Biresh Chandra Guha (3) – nearly all leaving their marks as eminent educationalists or industry managers.

A page level analysis of the publications reveals that during the entire period of 49 years Acharya Prafulla Chandra Roy authored 786 pages. He authored 712 (90.59%) pages in English and only 74 pages (9.41%) in German, which is very insignificant; 1930 was the most productive year in his life (Appendix D & Table 3).

Table 3: Language distribution of pages authored by A. P. C. Roy

Language	No. of pages authored	Percentage
English	712	90.59
German	74	9.41
Total	786	100

Periodical scattering was analyzed and shown in Tables 4 & 5. He published 109 research papers (69%) in seven international journals, namely, *Proceedings of Royal Society of Edinburgh*, *Proceedings of Chemical Society*, *Zeitschrift anorg amische and allge merie*, *Journal of Chemical Society*, *Annalen der Chemie*, *Themical News* and *Nature*. Among these journals, *Journal of Chemical Society* was the most preferred journal of Acharya Prafulla Chandra Roy, where he published 66 articles (60.5% of his international publications)

Thirty-one percent of his research articles were published in two national journals, namely *Journal of the Asiatic Society of Bengal* and *Journal of Indian Chemical Society*. He preferred to publish articles in the *Journal of Indian Chemical Society*; out of 49 national publications, 37 articles (75.5%) were published here. There were 2 periodicals that published only one article each. His publication density was 17.5.

Table 4: Periodical scattering of research papers of A. P. C. Roy

Sl. No.	Title of the periodicals	Total articles	Percentage	Cumulative Percentage	Period	
					First Articl	Last Articl

					e	**e**
1	*Proceedings of Royal Society of Edinburgh*	1	0.63	0.63	1888	1888
2	*Journal of the Asiatic Society of Bengal*	12	7.59	8.22	1894	1912
3	*Proceedings of Chemical Society*	20	12.67	20.89	1896	1914
4	*Zeitschrift anorg amische and allge merie*	11	6.96	27.85	1896	1934
5	*Journal of Chemical Society*	66	41.77	69.62	1897	1923
6	*Annalen der Chemie*	1	0.63	70.25	1901	1901
7	*The Chemical News*	2	1.27	71.52	1914	1914
8	*Journal of Indian Chemical Society*	37	23.42	94.94	1924	1936
9	*Nature*	8	5.06	100	1927	1936

Tables 5 and 6 show the broad area and field of Acharya Prafulla Chandra's research works. Theses tables indicate that his main areas of interest were chemistry of nitrogen oxyacids and their metal derivatives, organic thio-compounds and their metal derivatives, and chemistry of platinum group metals.

Table 5: Distribution of papers according to broad areas of research

Area of Research	**No. of paper**	**Percentage**
Chemistry of nitrogen oxyacids and their metal derivatives	51	32.28
Organic nitro compounds and nitrates	07	4.43
Organic thio compounds and their metal derivatives	41	25.95
Chemistry of Platinum group metals	23	14.56
Mercury alkyl/aryl compounds	10	6.33
Fluorination of organic compounds	05	3.16
Isomorphism and Chemical homology	07	4.43
Classical physical chemistry like catalysis, thermal decomposition, measurement vapour densities and ionic conductance	14	8.86

Table 6: Distribution of research papers according to fields of study

Fields of study	**Publication No.***	**Total**	**Percentage**
Conjugated sulphates of Copper and Magnesium Group	1, 117, 121, 125	4	2.53
Chemical Examination of Indian Foodstuff	2	1	0.63
Chemistry of Hypo-nitrites of Mercurous and Mercuric Mercury	4, 8-10, 29, 30, 74, 83	8	5.06
Chemistry of Nitrites of Mercurous and Mercuric Mercury	3, 5-7, 11-12, 14, 17, 21, 21-24, 33, 35, 37-38, 43-48, 54, 58, 59, 61, 63, 73, 75, 88-90, 124	33	20.89
Chemistry of Nitrates of Mercurous and Mercuric	18, 20, 34, 36, 40, 49	6	3.80

Mercury			
Nitrites and Nitrates of Metals other than Mercury	25-28, 31-32, 39, 50-51, 60	10	6.33
Alkyl and Aryl Nitrates and Nitro compounds	35, 52-53, 55-57, 62, 64, 67-71, 78, 81, 82	16	10.13
Organo-thio compounds and their metal derivatives	76-77, 84-87, 91-94, 97-100, 102, 104-106, 108, 113-114, 120, 126, 132, 137-141, 146, 154, 156	32	20.25
Chemistry of Platinum Group metals	42, 79, 103, 107, 110, 115-116, 118-119, 122-123, 127-128, 131, 133-134, 136, 142-145, 147, 151-152, 157	25	15.82
Mercury-Alkyl/ Aryl Chlorides and other Mercury compounds	13, 15-16, 19, 23, 65, 72, 95-96, 101	10	6.34
Isomorphism and Chemical Homology	129, 135, 153	3	1.90
Fluorination of Organic compounds	136, 148-149, 155, 158	5	3.17
Heterocyclic Compound	112	1	0.63
Phosphorus and Arsenic compounds	41	1	0.63
Discovery of Oxygen	111	1	0.63
Place of Mercury in the Periodic System	80	1	0.63
Chemical knowledge of the Hindus of Old	109	1	0.63

*the number referred to is in Table 1.

7. Conclusion:

This bibliometric study of Acharya Prafulla Chandra Roy ranks him among the

giants of chemistry. The results also show that despite the paucity of resources and research-supporting environment in the field of chemistry in his time, motivated researchers do not make it an excuse for significant productivity. Prafulla Chandra was an inorganic chemist by choice. Having a pragmatic mind-set, he was aware of the limitations of the research environment in India and adjusted his expectations modestly. Acharya Prafulla Chandra is one of the most prolific scholars in the field of chemistry. A rough analysis shows 55% of his papers' subject areas can be considered as inorganic, 30% as organic, and 10% as physical in nature. Bibliometric study of eminent scholars and prolific writers can play an important role in motivating and attracting young professionals towards research publications.

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Appendix A. Chronological list of Research Publications of A. P. C. Roy

1. Roy, P. C. (1988). On the conjugated Sulphates of the Copper-Magnesium Group. *Proceedings of Royal Society of Edinburgh*, *14*, 267-283.
2. Roy, P. C. (1894). On the Chemical Examination of Certain Indian Food Staffs, Part I, Fats & Oils. *Journal of the Asiatic Society of Bengal (JASB)*, *1*, 59-80.
3. Roy, P. C. (1896). On Mercurous Nitrite. *Journal of the Asiatic Society of Bengal (JASB)*, *65*, 1-9.
4. Roy, P. C. (1896). Mercury Hyponitrites. *Proceedings of Chemical Society, 12*, 217-218.
5. Roy, P. C. (1896). The interaction of Mercurous Nitrite and the Alkyl Iodides. *Proceedings of Chemical Society*, *12*, 218.
6. Roy, P. C. (1896). Uber Merkuronitrit. *Zeitschrift anorg amische and allge merie*, *12*, 365-374.

7. Roy, P. C. (1897). The nitrites of Mercury and the varying condition under which they are formed. *Journal of Chemical Society (JCS)*, *71*, 337-344.
8. Roy, P. C. (1897). Mercury Hyponitrites. *Journal of Chemical Society (JCS)*, *71*, 348-350.
9. Roy, P. C. (1897). On the action of Sodium Hyponitrite on Mercuric Solutions. *Journal of Chemical Society (JCS)*, *71*, 1097-1104.
10. Roy, P. C. (1897). On a new method of preparing Mercuric Hyponitrite. *Journal of Chemical Society (JCS)*, *71*, 1105-1106.
11. Roy, P. C. (1899). On the interaction of Mercurous and marcuric Nitrites with the Nitrites of Silver and Sodium. *Proceedings of Chemical Society* , *15*, 103.
12. Roy, P. C. (1899). The interactionof Mercurous Nitrite and Ethyl Iodide. *Proceedings of Chemical Society*, *15*, 239.
13. Roy, P. C. (1899). On Mercurous Iodide. *Proceedings of Chemical Society*, *15*, 239.
14. Roy, P. C. (1900). 1. Further researches in Mercurous Nitrite and its derivatives 2. On Mercurous Iodide and a new Method of its preparation. *Journal of the Asiatic Society of Bengal (JASB)*, *69*, 476-488.
15. Roy, P. C. (1901). A new series of Di Mercuri-ammonium Salts. Part I. *Proceedings of Chemical Society*, *17*, 96.
16. Roy, P. C. (1901). Ueber Mercuronitrit. *Annalen der Chemie*, *315*, 250-256.
17. Roy, P. C. (1902). Dimercurammonium Nitrite and its Haloid Derivatives. *Journal of Chemical Society (JCS)*, *81*, 644-650.
18. Roy, P. C. (1903). Dimerkurammoniumnitrat. *Zeitschrift anorg amische and allge merie*, *33*, 209-211.
19. Roy, P. C. (1903). A study on the constitution of Dimerammonium salts. *Journal of the Asiatic Society of Bengal (JASB)*, *72*, 1-4.
20. Roy, P. C. (1903). Dimercurammonium Nitrate. *Journal of the Asiatic Society of Bengal (JASB)*, *72*, 4.
21. Roy, P. C. & Sen, J. N. (1903). Decomposition of Mercurous Nitrite by heat. *Journal of Chemical Society (JCS)*, *83*, 491-494.
22. Roy, P. C. (1904). Mercuric Nitrite and its decomposition by heat. *Journal of Chemical Society (JCS)*, *85*, 523-527.
23. Roy, P. C. (1905). The Sulphate and the Phosphate of the Dimercurammonium series. *Journal of Chemical Society (JCS)*, *87*, 9-10.
24. Roy, P. C. (1905). Theory of production of Mercurous Nitrite and of its conversion into various Mercury Nitrates. *Journal of Chemical Society (JCS)*, *87*, 171-177.
25. Roy, P. C. (1905). The Nitrites of the Alkali metals and the metals of alkaline earths and their decomposition by heat. *Journal of Chemical Society (JCS)*, *87*, 177-184.
26. Roy, P. C. & Ganguli, A. C. (1905). The constitution of Nitrites, Part I. Two varieties of Silver Nitrites. *Proceedings of Chemical Society*, *22*, 278.
27. Roy, P. C. (1906). Fischer's salt and its decomposition by heat. *Journal of Chemical Society (JCS)*, *89*, 551-556.
28. Roy, P. C. & Neogi, P. (1906). Interactions of Alkyl Sulphates with Nitrites of the Alkali metals and metals of alkaline earths. *Journal of Chemical Society (JCS)*, *89*, 1900-1905.
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31. Roy, P. C. (1907). Cupric Nitrite. *Journal of Chemical Society (JCS)*, *91*, 1405-1407.
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33. Roy, P. C. (1907). The Double Nitrites of Mercury and the Alkali metals. *Journal of Chemical Society (JCS)*, *91*, 2031-2033.
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35. Roy, P. C. & Neogi, P. (1907). Preparation of aliphatic Nitro compounds by the interaction of the Alkalyl Iodides and Mercurous Nitrite. *Proceedings of Chemical Society*, *23*, 246.
36. Roy, P. C. (1907). Note from the chemical laboratory of the Presidency College Note No. 3 - On Silver Mercuroso- Mercuric Nitrate. *Journal of Asiatic Society of Bengal (JASB)*, *NS-3*, 137-138.
37. Roy, P. C. (1908). Molecular volumes of the Nitrites of Silver, Mercury and the alkali metals. *Journal of Chemical Society (JCS)*, *93*, 997-1000.
38. Roy, P. C. (1908). Molecular volumes of Nitrites of Silver, Mercury and the Alkali metals. *Proceedings of Chemical Society*, *24*, 75.
39. Roy, P. C. (1908). Lithium Nitrite and its decomposition by heat. *Proceedings of Chemical Society*, *24*, 75.
40. Roy, P. C. (1908). On the retardation and acceleration in the dissolution of Mercury in nitric acid in the presence of minute traces of Ferric Nitrate and Manganous Nitrate. *Journal of Asiatic Society of Bengal (JASB)*, *4*, 405.
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125. Roy, P. C. & Ray, N. N. (1929). On a New series of Double Sulphates of the Copper-Magnesium Group and the Sulphonium bases. Part I. *Journal of Indian Chemical Society (JICS)*, *6*, 27-30.
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157. Roy, P. C. & Ghosh, N. N. (1936). Complex compound of Iridium Part IV. *Journal of Indian Chemical Society (JICS)*, *13*, 138-140.
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Appendix B. Year wise distribution of research papers by A. P. C. Roy

Year	No. of research Publications	No. of Journals	Percentage	Author's Age
1888	1	1	0.63	27
1889	0	0	0	28
1890	0	0	0	29
1891	0	0	0	30
1892	0	0	0	31
1893	0	0	0	32
1894	1	1	0.63	33
1895	0	0	0	34
1896	4	3	2.53	35
1897	4	1	2.53	36
1898	0	0	0	37
1899	3	1	1.90	38
1900	1	1	0.63	39
1901	2	2	1.27	40
1902	1	1	0.63	41

1903	4	3	2.53	42
1904	1	1	0.63	43
1905	4	2	2.53	44
1906	2	1	1.27	45
1907	8	3	5.07	46
1908	4	3	2.53	47
1909	4	3	2.53	48
1910	4	2	2.53	49
1911	6	1	3.80	50
1912	16	3	10.14	51
1913	5	1	3.16	52
1914	6	3	3.80	53
1915	1	1	0.63	54
1916	4	1	2.53	55
1917	5	1	3.16	56
1918	0	0	0	57
1919	7	1	4.44	58
1920	1	1	0.63	59
1921	1	1	0.63	60
1922	2	1	1.27	61
1923	3	1	1.90	62
1924	4	1	2.53	63
1925	1	1	0.63	64
1926	6	1	3.80	65
1927	4	2	2.53	66
1928	4	1	2.53	67
1929	5	3	3.16	68
1930	6	3	3.80	69
1931	6	2	3.80	70
1932	2	2	1.27	71
1933	6	3	3.80	72
1934	5	3	3.16	73
1935	1	1	0.63	74
1936	3	2	1.90	75
Total	158	-	100	-

Appendix C. Distribution of research papers according to co-authors				
Sl. No.	Name of the co-author	Approx. Period of Study	Area of Research	No. of Paper
1	Sri Jatindra Nath Sen	1903	Thermal studies on Mercurious Nitrite	1
2	Sri Atul Chandra Ganguli	1905-1907	Thermal studies on Hyponitrous acid, Hyponitrites and Nitrites of Silver & Mercury	3
3	Sri Panchanan Neogi	1906-1907	Alkyl Sulphates, Nitrites & Nitro compounds	2
4	Sri Nagendra Nath Sen	1909	Phosphorus & Arsenic compounds	1
5	Sri Atul Chandra Ghosh	1910	Thermal studies on Dimercurammonium nitrites	1
6	Sri Satish Chandra Mukherjee	1910	Cryoscopic studies on ionisation of nitrites	1
7	Sri Jitendra Nath Rakshit	1911-1913	Organo nitrite derivatives preparation, reaction & physiochemical study	10
8	Sri Hemendra Kumar Sen	1911	Thermal studies on organo Hyponitrite derivaties	1
9	Sri Rashik Lal Dutta	1911	Organo nitrites: preparation, reactivity, physical studies & thermal decomposition	2
10	Sri Nil Ratan Dhar	1912-1913	Electrical Conductance behaviour of Mercury alkyl chlorides and nitrites	3

11	Sri Tincowry De	1912	Physiochemical studies on ammonium nitrite & organo nitrites	2
12	Sri Rajedra Lal De	1913-1916	Physiochemical studies on alkali & alkaline earth metal nitrates	2
13	Sri Sarat Chandra Jana	1913	Physiochemical studies on ammonium nitrate, benzoate and acetate	1
14	Francis Vito Fernandes	1914	Organo thio-compounds	1
15	Sri Manik Lal De	1916-1917	Physiochemical studies of nitrous acid synthesis of organo Thio-compounds	3
16	Sri Jnanendra Chandra Ghosh	1917	Physiochemical studies on ionization of nitrious acid	1
17	Sri Prafulla Chandra Guha	1919	Mercury mercaptide nitrates and related compounds: preparation and reactivity	4
18	Sri Radha Kishen Das	1919	Organo thio-compounds	1
19	Sri Kali Kumar Kumar	1921	Physiochemical studies on sulfonium compounds	1
20	Sri Gopal Chandra Chakrabarty	1923	Mercaptans	1
21	Sri Prafulla Kumar Bose	1923	Mercaptans	1

22	Sri Kshitish Chandra Boseray	1925-1929	Platinum group metals Chemistry, Varying valency of platinum, Organo sulphur compounds, Double Sulphates of Cu, Mg & Phosphonium bases	9
23	Sri Biresh Chandra Guha	1926	Condenced heterocycles and Varying valency of platinum	3
24	Sri Nirmalendu Nath Ray	1927-1929	Double Sulphates of Cu Mg compound Phosphonium bases & Organo phosphonium nitrites	1
25	Sri Purna Chandra Mukherjee	1929	Platinum and gold complexes with organo thiocompounds	1
26	Sri Sushil Kumar Mitra	1929	Organo sulphur compounds	1
27	Sri Dinesh Chandra Sen	1930	Gold complexes with Organo sulphur compounds	1
28	Sri Nadiabehari Adhikari	1930-1934	Alkyl sulfonium compounds with mercury, antimony, silver, zinc, cadmium & Iridium complexes with organo sulphur compounds, amines, ammonia	8
29	Sri Sailesh Chandra Sengupta	1930-1933	Variable valency of platinum	2
30	Sri Amerandra Nath Ray	1931	Alkyl sulfonium compounds with mercury, antimony	2
31	Sri Harendra Nath Ray	1931	Organo sulphur compounds of silver	1

32	Sri Sanat Kumar Banerjee	1931	Alkyl sulfonium compounds with zinc, cadmium	1
33	Sri Nripendra Nath Ghosh	1933	Varying valency, platinum group metal complexes with organo sulphur compounds, organo thio-compounds	5
34	Sri Sushil Kumar Mitra	1933	Organo thio-compounds	1
35	Sri Pulin Behari Sarkar	1933	Fluorination of organic compounds	1
36	Sri Amit Roy	1933	Fluorination of organic compounds	1
37	Sri Harish Chandra Goswami	1935	Fluorination of organic compounds	1
38	Sri Anil Chandra Roy	1935	Fluorination of organic compounds	1

Appendix D. Year wise pages of research papers authored by A. P. C. Roy

Year	No. of research Publications	No. of Journals	Pages Authored	Percentage
1888	1	1	17	2.16
1894	1	1	22	2.80
1896	4	3	22	2.80
1897	4	1	21	2.67
1899	3	1	3	0.38
1900	1	1	13	1.65
1901	2	2	8	1.02
1902	1	1	7	0.89
1903	4	3	12	1.53
1904	1	1	5	0.64
1905	4	2	18	2.29

1906	2	1	12	1.53
1907	8	3	26	3.31
1908	4	3	7	0.89
1909	4	3	17	2.16
1910	4	2	8	1.02
1911	6	1	24	3.05
1912	16	3	43	5.48
1913	5	1	27	3.45
1914	6	3	12	1.53
1915	1	1	4	0.51
1916	4	1	32	4.08
1917	5	1	25	3.18
1919	7	1	50	6.36
1920	1	1	3	0.38
1921	1	1	2	0.25
1922	2	1	11	1.39
1923	3	1	19	2.42
1924	4	1	31	3.94
1925	1	1	13	1.65
1926	6	1	56	7.12
1927	4	2	23	2.93
1928	4	1	22	2.79
1929	5	3	26	3.31
1930	6	3	52	6.62
1931	6	2	37	4.71
1932	2	2	11	1.39
1933	6	3	20	2.54

1934	5	3	16	2.04
1935	1	1	3	0.38
1936	3	2	6	0.76
Total	158	-	786	100

Appendix E. Year wise distribution of research papers in periodicals

Year	**Name of Journal**								
	Proceedings of Royal Society of Edinburgh	*Journal of the Asiatic Society of Bengal*	*Proceedings of Chemical Society*	*Zeitschrift anorg amische and allgemerie*	*Journal of Chemical Society*	*Annalen der Chemie*	*The Chemical News*	*Journal of Indian Chemical Society*	*Nature*
1888	1	-	-	-	-	-	-	-	-
1894	-	1	-	-	-	-	-	-	-
1896	-	1	2	1	-	-	-	-	-
1897	-	-	-	-	4	-	-	-	-
1899	-	-	3	-	-	-	-	-	-
1900	-	1	-	-	-	-	-	-	-
1901	-	-	1	-	-	1	-	-	-
1902	-	-	-	-	1	-	-	-	-
1903	-	2	-	1	1	-	-	-	-
19	-	-	-	-	1	-	-	-	-

04									
1905	-	-	1	-	3	-	-	-	-
1906	-	-	-	-	2	-	-	-	-
1907	-	1	1	-	6	-	-	-	-
1908	-	1	2	-	1	-	-	-	-
1909	-	1	-	1	2	-	-	-	-
1910	-	-	2	-	2	-	-	-	-
1911	-	-	-	-	6	-	-	-	-
1912	-	4	5	-	7	-	-	-	-
1913	-	-	-	-	5	-	-	-	-
1914	-	-	3	-	1	-	2	-	-
1915	-	-	-	-	1	-	-	-	-
1916	-	-	-	-	4	-	-	-	-
1917	-	-	-	-	5	-	-	-	-
1919	-	-	-	-	7	-	-	-	-
1920	-	-	-	-	1	-	-	-	-
1921	-	-	-	-	1	-	-	-	-
1922	-	-	-	-	2	-	-	-	-
1923	-	-	-	-	3	-	-	-	-
1924	-	-	-	-	-	-	-	4	-

1925	-	-	-	-	-	-	-	1	-
1926	-	-	-	-	-	-	-	6	-
1927	-	-	-	-	-	-	-	3	1
1928	-	-	-	-	-	-	-	4	-
1929	-	-	-	1	-	-	-	3	1
1930	-	-	-	2	-	-	-	3	1
1931	-	-	-	1	-	-	-	5	-
1932	-	-	-	1	-	-	-	1	-
1933	-	-	-	2	-	-	-	2	2
1934	-	-	-	1	-	-	-	2	2
1935	-	-	-	-	-	-	-	1	-
1936	-	-	-	-	-	-	-	2	1
Total	1	12	20	11	66	1	2	37	8