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# Dr. P. C. RAY\*

## BIRTH AND PARENTAGE

Dr. Prafulla Chandra Ray was born in 1861 at Raruli-Katipara, a small village now in the District of Khulna, of a family well-known for generations in that part of Bengal. The village is situated on the bank of the river Kapotaksha, immortalised by the great Bengali poet, Michael Madhusudan,† in a sonnet written at Versailles. His father, the late Harish Chandra Ray, who died in 1894 at the age of 69—a good Persian scholar imbued with the writings of Sadi and Hafiz—was a student of the Krishna-gur College in the early forties of the last century, when the celebrated Captain D. L. Richardson was its Principal. He was a well-read man who held enlightened views on many social questions and was a

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\* The writer of this sketch has made free use of sketches of Dr. Ray's life which appeared in the pages of the "Indian World," the "Calcutta University Magazine" and the "Century Review," and also of appreciations written by some of Dr. Ray's pupils notably Mr. F. V. Fernandez.

† *Michael Madhusudan Dutt: A sketch of his life and career*, Price As. 4. (G. A. Natesan & Co., Madras.)

pioneer in introducing English education in his own district. Harish Chandra was a member of the British Indian Association in the early sixties of the last century, and was well acquainted with, among others, the late Raja Digambar Mitra, Kristo Das Pal, Sishir Kumar Ghosh and Pandit Iswar Chandra Vidyasagar. The local Model Vernacular School, which was founded and maintained mainly at the expense of the late Harish Chandra Ray, has now grown into a Model English High School, and is located in the very ancestral house of Dr. Ray, for the up-keep of which he spends annually a handsome amount. This ancestral home of Dr. Ray is more than a century old and is partly in a dilapidated condition, but is still considered to be one of the finest buildings in the whole district.

#### EDUCATION

Dr. Ray received his early training at his father's school; but his father, anxious that his sons should receive the best possible education, settled down at Calcutta towards the end of 1870. Young Prafulla Chandra was admitted as a pupil of the Hare School immediately and was there for four years. In 1874, he got a severe attack of dysentery and suffered from it for nearly two years and, consequently, was absent from school for a long period; but he utilised this time in

devouring the contents of a splendid library got together by his father and his eldest brother. Being of very regular habits and disentangled from the trammels of ordinary school lessons—he kept up his studies without let or hindrance, in spite of his malady, and got passionately attached to the works of Goldsmith, Addison and some other classical English authors. When sufficiently recovered from his malady, he took his admission into the Albert School of Calcutta, then in the heyday of its glory under the rectorship of the late Krishna Vihari Sen, and here he at once made his mark as a brilliant student. From Krishna Vihari young Prafulla Chandra also imbibed a deep and abiding love of English literature. At this time, he was a constant listener to the lectures and sermons of Keshub Chandra Sen, and was slowly attracted to the Brahmo Samaj of which he has been a member since 1882. At this period of his life (about 1875-77), he also caught the enthusiasm inspired by the eloquence of the late Ananda Mohan Bose and Mr. Surendranath Banerjea and felt the impulses of a higher patriotic life.\*

From 1879 to 1882, he was a student of the Metropolitan Institution. He has often said

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\* Vide "*Essays and Discourses*" of Dr. Ray—*Article on Ananda Mohan Bose.*

that the one fascination he had for joining Vidyasagar's College was that he should be able to sit at the feet of Mr. Surendranath Banerjea. Indeed, the exposition of Morley's *Burke* and Burke's *Reflections on the French Revolution* from the lips of the great Bengalee orator made a life-long impression on Dr. Ray. All this time young Ray was also a student of the Presidency College (in the scientific department) where he attended the lectures of Sir John Eliot in physics and of Sir Alexander Pedler in chemistry. Dr. Ray's father, having lost in the meantime a considerable portion of his ancestral fortunes, was precluded from giving his brilliant son the benefit of an education in England. Young Ray, however, slowly and quietly prepared himself for the Gilchrist Scholarship Examination, and it is singular that his father and other relations were kept entirely in the dark about his intentions, his eldest brother alone having been taken into his confidence. In 1882, Ray proceeded to England as a Gilchrist Scholar and studied at Edinburgh for six years. Although his taste and inclination lay towards English literature and history, he realised that the future progress of India was bound up with the pursuit of science, and thus he gradually allowed himself to be weaned away from his

former studies. At Edinburgh, he was the pupil of the celebrated Peter Guthrie Tait and of Alexander Crum Brown—two mighty intellects in the departments of physical science and chemistry—and through their teachings he shortly came to be devotedly attached to the study of chemistry. It will be interesting to note here that amongst his fellow-students were Prof. James Walker, F.R.S., now occupying the Chair of Chemistry at Edinburgh and the late Prof. Hugh Marshall, F.R.S., Professor of Chemistry, University College, Dundee. Writing from the University of Edinburgh, under date 5th April, 1888, Prof. Crum Brown states:—

I have known Dr. P. C. Ray since he came to this University in 1882, and have watched his career with much interest. Having laid a sound foundation of general scientific knowledge, he devoted himself especially to Chemistry. He took the degree of B. Sc. in 1885, and that of D. Sc. in 1887. He held the Hope Prize Scholarship in Chemistry during the year 1887-88. He worked in the Chemical Laboratories during the Summer and Winter Sessions, from May 1883 till March 1888, latterly assisting Dr. Gibson and myself in the work of the Laboratory. As much of his work was done under my own observation, I can speak with confidence as to his ability and knowledge. He has an extensive and sound acquaintance with all branches of theoretic Chemistry and is a careful and accurate analyst. He has shown that he has the capacity for original investigation—his thesis for the degree of D. Sc. being a piece of excellent analytical work, well arranged, and thoroughly and conscientiously carried out.

“INDIA BEFORE THE MUTINY”

Although Chemistry literally claimed him as her own, Dr. Ray still continued to be a close student of English politics and of Indian Economics. His *Essay on India before and after the Mutiny*, written on the eve of his appearance for the B. Sc. Examination at Edinburgh, bears impress of mature study of Indian problems. The Essay was warmly appreciated at the time, and principal Sir William Muir pronounced it as “bearing marks of rare ability.” The leading newspaper of the Scottish capital, the *Scotsman*, observed: “It is a most interesting little volume, and we do not profess to wonder in the least that it has earned a considerable amount of popularity. It contains information in reference to India which will not be found elsewhere, and it is of the utmost notice.”

John Bright, in acknowledging a copy of the booklet, wrote a long letter to the author in which he said:—

I regret with you and condemn the course of Lord Dufferin in Burma. It is a renewal of the old system of crime and guilt, which we had hoped had been for ever abandoned. There is an ignorance on the part of the public in this country and great selfishness here and in India as to our true interests in India. These departures from morality and true statesmanship will bring about calamity and perhaps ruin, which your children may witness and deplore.



## PROFESSOR

On his return to India he joined the Presidency College of Calcutta as a professor, and since that year (1889) he has practically confined all his attention to his chemical researches. The results of his devotion at the Chemical Laboratory of this College, particularly in the years between 1896-1898, were embodied in his first scientific publication under the title of "Chemical Research at the Presidency College." This little brochure was "affectionately inscribed" to "my friend, Prithwis Chandra Ray, author of the *Poverty Problem in India*," and at once established his reputation as a great Indian scientist. In 1904, he was deputed by the Government of Bengal to visit the principal chemical laboratories of Europe and was everywhere received with open arms by chemists and savants. At a meeting of the French Academy of Sciences, Mr. Troost welcomed Dr. Ray in words of generous appreciation on behalf of that august body.

"Presence of a Foreign Savant":—

"The President announces that Mr. Rây, Professor of Chemistry at Calcutta and author of important works on the nitrites as also of History of Hindu Chemistry, is present at our meeting to-day and offers him welcome." *La Nature*, March 11, 1905.

## A CAPTAIN OF INDUSTRY

The story of the foundation and growth of the Bengal Chemical and Pharmaceutical Works reads like a romance. It has proved to the world abroad that the Bengalees possess a marvellous brain, that in spite of unfavourable circumstances they can build up a vast industry only by the virtue of perseverance and tenacity. The B.C.P.W. is a standing monument to the industry and intellectual capacity of Dr. Ray. He had to fight against enormous odds in laying deep the foundation of this business. "The Bengal Chemical and Pharmaceutical Works had its birth," observed its founder, "and early struggles in the dark and dingy rooms of a house in Upper Circular Road, and it started with the modest sum of Rs. 800." It was about twenty-six years ago that Dr. Ray launched this new industry. Though he was then a Professor of the Presidency College, his income only amounted to Rs. 250 a month. He had in those days to pay off some ancestral debts, besides his charity was never restricted to one or two students. With this meagre income, he worked wonders in the field of industry. Many young men complain of the lack of sufficient capital to carry on a business, but here is a concrete example of one of the greatest sons of Bengal who managed to establish a good business even without sufficient funds. One of the many

causes which go to work out the failure of many an indigenous industry in India is the lack of purpose and firm determination. When the wave of Swadeshi enthusiasm passed over the country, there came to light many new industries, but how many of them are found now in a prosperous condition? How many have survived in the struggle for existence? Their number can be counted on one's finger's ends. The industry set up by Dr. Ray many years before the Swadeshi awakening, however, is still as full of hope and promise as ever.

That "dark and dingy" room saw the birth of this new industry. There could be found in those days various utensils strewn about containing sulphuric acid here and nitric acid there, all in the process of distillation. The young workers were busy in making thousand and one things and in carrying out experiments.

Fortunately for Dr. Ray, he received the co-operation and assistance of a few able workers, who were ready to do their "bit" for the benefit of chemical industry in India. First came his old friend, Dr. Amulya Charan Bose. He was a sincere worker in this field. He assisted Dr. Ray with all his heart and never looked for gain. Actuated by the love of country, his aim was always free from gross personal motives. Another

young worker, Satish Chandra Sinha, joined them soon after passing the M. A. examination. He was really a martyr in the cause of science, for shortly after he died of prussic acid poisoning. Another silent worker was Prof. Chandra Bhusan Bhaduri, who never advertised himself. It has been maintained that when the story of the development of the chemical industry in Bengal comes to be written, his name is sure to obtain a high rank as one of the early promoters and pioneers.

Thus the Company, originally started as a small private concern for the manufacture of medicines and other chemical preparations, has now rapidly increased its many-sided activities. Year after year the Company made large strides and now it stands as one of the most successful industries in India. "With the recent expansions which have already been taken in hand, it will soon cover an area of 24 bighas (8 acres) and its present capital of 5 lacs will have to be doubled with a view to the installation of new plant." As we have said before, the Company was at first a private concern, but as the field of its activity began to expand rapidly, Dr. Ray did not think it proper to keep the whole income to himself. His patriotism prompted him to make it a limited company, throwing open its shares to all.

“It has always been a fixed principle with the Directors of this business,” said Dr. Ray, the founder-Director, “not to take in any one as a chemist whose knowledge is not up to the M. Sc. standard of our University.” Be it mentioned here that the Company has now five expert chemists working. They are all former students of Dr. Ray. Time and again it has been complained that the Bengali does not possess any organising capacity. Here is an industry which has been conceived, initiated, and managed solely by Bengali brains, energy and pluck, and it has never been necessary to call in the aid of any foreign “experts.” This clearly demonstrates that the successful application of science to industry is by no means incompatible with Bengali genius.

As Dr. Travers of the Indian Scientific Institute said the Bengal Chemical Works is a piece of research work for which Professor Ray and Mr. C. Bhaduri ought to be proud. In the words of the same authority, “the construction and management of the works is the work of the past students from the chemistry department of the Presidency College, acting under the advice of these gentlemen. The design and construction of the sulphuric acid plant and of the plant required for the preparation of drugs and other products involved a large

amount of research work of the kind which is likely to be of the greatest service to this country, and does the greatest credit to those concerned." (*Century Review*).

#### LITERARY INTERESTS

Dr. Ray is a man of many interests. He has not been content with only building up an industrial concern but takes a keen interest in Bengali literature and is himself a careful student of it. Ten years ago he was called upon to preside over the Provincial Literary Conference in which he read a remarkable paper on the "Place of Science in Literature."\* He has contributed many articles to several Bengali periodicals, besides writing occasionally to the *Indian World*.†

Of Shakespeare, Dr. Ray is immoderately fond and is never tired of reading and re-reading the great English Classic. Emerson, Carlyle, Epictetus and Marcus Aurelius have deeply tinged his life. His favourite novels are those of Thackeray, George Eliot and Dickens,—he cannot tolerate any present-day novelists—not even Hall Caine or Marie Correlli.

#### DR. RAY'S RESEARCHES AND DISCOVERIES

It was in December, 1895, that Dr. Ray

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\* For a translation of the paper, see "Essays and Discourses, etc."

† A high-class monthly (and latterly a weekly) Review published in Calcutta and edited by Mr. Prithwis Chandra Ray from 1905 to 1914. Its publication has now been suspended.

rose to fame and became known to the scientific world by his celebrated discovery of mercurous nitrite. In his presidential address delivered before the Asiatic Society in 1896, Mr. (now Sir Alexander) Pedler said:—"Dr. P. C. Ray, by his discovery of the method of preparation of this compound, has filled up a blank in our knowledge of the mercury series."

The reactions of nitric acid with mercury have been a favourite subject with the chemists and their predecessors, the iatrochemists, since the 15th century A. D., if not earlier. Dr. Ray, however, was the first not only to point out distinctly but to isolate the initial product, namely "mercurous nitrite." This remarkable discovery is now almost a matter of ancient history, but how it was welcomed and received at the time will be evident from the extracts given from two scientific journals quoted below.

*Nature*, 28th May, 1896, thus reviewed Dr. Ray's discovery of Mercurous Nitrite:—

The "Journal of the Asiatic Society of Bengal" can scarcely be said to have a place in our Chemical Libraries; the current number, however, contains a paper by Dr. P. C. Ray of the Presidency College, Calcutta, on mercurous nitrite, that is worthy of note. During a preparation of mercurous nitrate by the action of dilute nitric acid in the cold on mercury, yellow crystals were deposited which, upon examination, proved to be mercurous nitrite. The analysis proved somewhat difficult.....The fact, that the

nitrite is stable in strongly acid solutions, is an additional proof of the views held by Dr. Divers as to the "nitronic" constitution of the nitrites of copper, mercury and bismuth. The stability of silver nitrite towards nitric acid has already been noticed by Acworth and Armstrong, and by Russell, and the behaviour of mercurous nitrite is closely analogous. Dr. Ray proposes in a subsequent communication to give the results of an attempt to prepare fatty nitro-derivatives from this compound.

*The Chemist and Druggist* of London, 25th July, 1896, observed:—

It has been left to a Bengali chemist, Dr. P. C. Ray, to demonstrate that the not unfamiliar yellow crystalline deposit that is obtained by contact of dilute nitric acid with mercury in the cold is mercurous nitrite. This substance is not so much as mentioned in "Roscoe" and "Schorlemmer," nor is there any reference to it in "Watt's Dictionary of Chemistry." Dr. Ray's discovery has been well received in Chemical circles.

Among the famous chemists of Europe, Sir Henry Roscoe and M. Berthelot were the first to congratulate Dr. Ray and welcome his discovery.

Mercurous nitrite has proved to be the fruitful parent of an interesting series of compounds, and during the last 22 years Dr. Ray singly or in co-operation with his pupils has been incessantly busy in working them up. To an average lay reader the details of these discoveries may not prove intelligible, and we shall therefore content ourselves with presenting the outstanding features of some of them. One very striking outcome of the earlier researches in this field has been the



establishment of an identity in the properties of "monad" mercury and silver. It was at a meeting of the Asiatic Society of Bengal in 1907 that Dr. Ray read a short paper entitled "silver mercurioso-mercuric oxynitrate," and a more elaborate account of the subject based upon further investigations appeared in the *Journal of the Chemical Society of London*.

Dr. Ray's researches have all along shown that univalent mercury should be placed side by side with silver and his latest paper adduces most convincing proof in this direction. He has at last succeeded in preparing a compound of univalent mercury in which a portion of this metal is isomorphously replaced by its analogue, silver. This isomorphous or to adopt the happy language of the greatest living authority on the subject, Groth—"vicarious" substitution of mercury by silver, will no doubt be welcomed by the scientific world. Why should one and the same metal play this sort of double role? We are at the dawn of a new chemistry. Sir W. Ramsay has shown that radium is slowly transformed into helium. Possibly the 20th century is destined to throw a flood of light on the duality as also on the transmutation of metals.—*The "Empire."*

It was no mean compliment which the late Professor Divers, F. R. S., paid to Dr. Ray's researches when, in a paper read before the Society of Chemical Industry in 1904 on the dissolution of metals in nitric acid, he made the following introductory remark:—

The occasion for presenting the theory in a more developed form to the Society has been given by the reading last month to the Chemical Society of an important paper on mercurous nitrite by Prof. Ray

of the Presidency College, Calcutta.—*Journ. Soc. Chem. Ind.*

The limited space at our disposal forbids our following in detail the substance of some 80 memoirs on the subject of the 'nitrites' and 'hyponitrites.' The important discovery of the 'amine' nitrites by Dr. Ray and his co-worker, Mr. Jitendranath Rakshit, deserves, however, more than a passing notice; and we cannot do better than quote the brief but graphic notice of it which appeared in the columns of a Calcutta print at the time:—

The very preliminary note on methylammonium nitrite by Dr. Ray and Mr. Jitendranath Rakshit which was read at the last December meeting of the Asiatic Society has not, we are afraid, attracted the attention it deserves. The authors with commendable unobtrusiveness announce in this communication the preparation of a new compound which is destined to be hailed in the chemical world as a startling discovery. Sir William Ramsay, if our memory serves us right, has somewhere aptly said that a chemical process involves a marriage of elements (and of compounds as well). Now, the chemical union of methylamine and nitrous acid has been the despair of successive generations of chemists; all the attempts to bring them together under the matrimonial yoke have hitherto failed, as these two compounds are mutually destructive of each other and their inter-action almost instantaneously results in the formation of methyl alcohol and liberation of nitrogen. Indeed, this very reaction, as every tyro in organic chemistry knows, is made use of for diagnosis of primary amines. The authors have evidently proved to be efficient chemical match-makers, as in their hands methylamine and nitrous acid have not forgotten their antagonistic

properties but have agreed to be united in chemical wollock, giving rise to a beautiful crystalline yellowish compound. We understand that Dr. Ray has already been the recipient of warm congratulations from eminent English chemists, and it would seem almost impertinent to add our own. It is believed that since the discovery of mercurous nitrite by Dr. Ray in 1895, a preliminary account of which was also communicated to the Asiatic Society at the time and which at once made the name of its discoverer known to the scientific world, the laborious researches in the Chemical Laboratory of the Presidency College have not been rewarded with so rich a find.

Another most important discovery was the preparation and volatilisation of ammonium nitrite. The "Annual Report on the Progress of Chemistry," issued by the Chemical Society, which embody the most important contributions on the subject by the chemists throughout the world, thus noticed in successive issues the significance of the Bengalee Chemist's discoveries from 1904 onwards.

"Ray has obtained mercuric nitrite by the interaction of mercuric chloride and silver nitrite.

"Ray has continued his researches on the nitrites discussing the conditions influencing the formation of ten different products of the action of nitric acid on mercury. This author has also prepared the nitrites of alkali and alkaline earth metals which are formed by the interaction of the chlorides on silver nitrite. The solutions of these nitrites may

be evaporated in contact with the air without undergoing oxidation. These nitrites have a yellow colour, the depth of which increases with the atomic weight of the metal. Magnesium nitrite is the least stable of those of the alkaline earths forming as magnesium does in many other cases, a link between the nitrites of zinc and cadmium and those of calcium, strontium, and barium. Ray and Ganguli have recently described two varieties of silver nitrite."—*Annual Report, 1905.*

"Continuing his patient study of the nitrites, P. C. Ray has shown that, if a solution of ammonium nitrite is heated in a vacuum, very little gas is evolved below  $40^{\circ}$ ; on cooling, most of the salt crystallises. If the temperature is raised to  $70^{\circ}$ , slow decomposition takes place, but a considerable quantity of the salt appears as sublimate."—*Annual Report, 1909.*

"Ray, in his long and painstaking researches on the nitrites, has studied the effect of adding various nitrates in small quantity to nitric acid while it is allowed to act on mercury. It has been found, whilst the nitrates of sodium, potassium and manganese have an accelerating effect on the action, ferric nitrate had a distinctly retarding effect."—*Annual Report, 1911.*

During a recent visit to England, Dr.

Ray took advantage of the opportunity to read two papers on his latest researches. The paper on the "vapour density of ammonium nitrite" has won the admiration of eminent chemists. We can only make room for two short extracts bearing upon the subject:—

*The Chemist and Druggist* of 6th June, 1912, wrote:—

Dr. V. H. Veley, in welcoming Prof. Ray said he was an illustrious representative of a great Aryan nation which had attained a high degree of civilisation and discovered many chemical processes when this country was but a dismal swamp. Professor Ray had shown contrary to text-books statements that ammonium nitrite could be obtained in a stable crystalline condition and volatilised. He concluded by paying a warm tribute to Dr. Ray and his pupils for their valuable researches on ammonium—and the amine nitrites. The chairman also extended, on behalf of the Society, a hearty welcome to Prof. Ray, endorsing Dr. Veley's remarks.

*Nature*, August 15, 1912, remarked:—

Prof. P. C. Ray has added to his success in preparing ammonium nitrite in a tangible form, a further accomplishment in determining the vapour density of this very fugitive compound. . . .

#### "HISTORY OF HINDU CHEMISTRY"

We have not space here to notice more in detail the contributions of Dr. Ray to the chemical world. But no review of his life and work can be complete without a reference to his monumental work, "*The History of Hindu Chemistry*," in which he has completely

proved to the world at large, by reference to old Sanskrit texts, the antiquity of the knowledge of chemistry in this country. The first volume of the "History" appeared in 1902 as a result of the persistent study and toil of fifteen years, and was so favourably received that it was necessary to publish a second edition in 1905. The second volume came out about five years after the first. M. Berthelot, the illustrious French Chemist, reviewed the first volume of the work at considerable length in the columns of the "Journal des Savants." We quote the concluding lines:

A new and interesting chapter has been added to the history of sciences and of human thought.

The Vice-Chancellor of the Durham University in conferring on him the honorary degree of D. Sc. said in 1912:—

"A keen and successful investigator, he has long made his mark by contributions to scientific periodicals, both English and German, but his fame chiefly rests on his monumental 'History of Hindu Chemistry'—a work of which both the scientific and linguistic attainments are equally remarkable, and of which, if of any book, we may pronounce that it is definitive."

And that great German author, Hermann Schelenz, one of the greatest of the living authorities on Pharmaceutical Chemistry, and

author of the *History of Pharmacy* ("Geschichte der Pharmazie") went into ecstasy over Dr. P. C. Ray's *History of Hindu Chemistry*, and authoritatively declared as his deliberate opinion that the mastery of chemical processes, as elaborately described in the Hindu work, *Rasaratnasamuchchaya*, upon which Dr. Ray has copiously drawn in his *History*, shows that the Hindu chemists were far ahead of their European contemporaries of the 13th and 14th centuries A.D. In order to introduce our readers to the subject matter of this book, we can do no better than quote a few sentences from a translation of the review of the work which appeared in the *Journal Asiatique* over the signature of that eminent scholar and orientalist, Mons. Sylvain Levi of Paris. He writes:—

In his first volume, Mr. Ray has given a picture of the chemical knowledge of ancient India, which he divides into four periods: the Ayurvedic period, from the pre-Buddhist era to about 800 A.D.; the Transitional period, from 800 to 1100 A.D.; the Tantric period, from 1100 to 1300 A.D.; the iatro-chemical period from 1300 to 1550 A.D. In the first period he places Charaka, Susruta, the Bower Mss. and Vagbhata; in the second, Vrinda and Chakrapani; in the third, *Rasarnava*; in the fourth *Rasaratnasamuchchaya*. To this list have been added a few monographs and a collection of Sanskrit texts. The second volume may be regarded as the continuation of the first. The author has during this interval discovered or secured new materials, which has enabled him to throw further light upon the questions

previously taken up for solution. In particular the *Rasaratnakara* of Siddha Nagarjuna has floated before his vision as the figure of the great Buddhist philosopher who has acted so powerfully upon Indian thoughts. In this treatise on alchemy, Nagarjuna comes in as a friend of king Salivahana—a connection which has the support of an old tradition, as also his disciple, Ratnaghosa, whose name, though as yet unknown, has the probability of being a real personage. Alchemy was introduced into the sphere of Buddhism by Nagarjuna, which was almost neglected up till his time. Mr. Ray has undeniably proved, not without surprise, the grand role played by Buddhist monks in alchemy and the preponderating part of Buddhism in the Tantric literature. Even in the thirteenth century, a Hindu Chemist, named Gobindacharya, author of *Rasasara*, declares to have composed his work "after having derived his information from Buddhist sources," as also "from the Buddhists of Tibet." Mr. Ray also notices a good many Hindu chemical Tantras and gives a summary of them and continues the list to about the seventeenth century. The conclusion at which Mr. Ray arrives is that Indian alchemy is of indigenous origin.

The concluding words of his "History" will be ever memorable as the sombre but ennobling reflections of one of the choicest of those who "searched truth with many a sigh:"

"It is with mingled feelings that I mark the hour of my final deliverance from a self-imposed task which has occupied all my spare time during the last 15 years and more, feelings not unlike those which overpowered the Historian of the Roman Empire. The reader, I hope, will forgive me if I venture to give expression to them in the words of



Edward Gibbon himself: 'I will not dissemble the first emotions of joy on the recovery of my freedom \* \* \* \* But my pride was soon humbled and a sober melancholy was spread over my mind, by the idea that I had taken an everlasting leave of an old and agreeable companion.' The Hindu nation with its glorious past and vast latent potentialities may yet look forward to a still more glorious future, and if the perusal of these lines will have the effect of stimulating my countrymen to strive for regaining their old position in the *intellectual hierarchy* of nations, I shall not have laboured in vain."

AS A TEACHER AND FOUNDER OF A  
SCHOOL OF CHEMISTRY

As a teacher of young men for over a quarter of a century and having intimate association and close familiarity with a large number of students, Dr. Ray holds that the Bengali intellect is second to none in richness and fertility, though unfortunately it ripens rather too early and decays very prematurely. It is stated that the Bengali youth lacks the characteristic go, pluck, determination and the close application of the youths of Europe and Japan. The Bengali, according to Dr. Ray, seldom brings to bear upon anything sustained and life-long devotion and tenacity of purpose—his enthu-

siasm is short-lived and is of a flashy and dashing nature.

Dr. Ray has been loved and adored by his students very much in the ancient Indian spirit. On the eve of his retirement from the Presidency College, his students presented him with an address of farewell in which they said :—

Your place in the college, sir, we are afraid can never be filled. Men will come and men will go but where else can we possibly expect to find again that sweetness of disposition, that vigour of simplicity, that unwearied spirit of service, that broad-based culture, that wisdom in deliberation and debate which for the space of thirty years or more endeared you so much to your pupils ?

Yours was, sir, indeed no small achievement. Your way of life, with its distinct Indian traits recalled us to the sweet and simple and manly days of Indian attainment. You have been to us all through a guide, philosopher and friend. Easy of access, ever-pleasant, ever willing to help the poor and needy student with your counsel and your purse, living a life of sturdy, celibate simplicity, with a genuine patriotism, not loud but deep, you have been to us an ancient Guru reborn, a light and an inspiration from the treasure-house of old Indian spirituality.

Dr. Ray has always reciprocated the love of his students, and it has been his practice for some years past to invite some of his advanced pupils to take part in his research work. As the fascination grows, these young aspirants become devoted to the cause of original investigation and stick to the work. Year after year, their number has been increasing

till practically a school of chemists has now been established in Calcutta without any fuss or ado. We can measure the success of Dr. Ray's school when we see that the journals of chemistry now-a-days contain rather frequent contributions of genuine merit either from him or his pupils whom he has literally trained and inspired. The May and August numbers for 1911, of the *Transactions of the Chemical Society*, London, contain simultaneously five contributions from him and his pupils. Scarcely a month elapses without some additional discoveries of his or his pupils. His own contributions up-to-date have been close upon eighty, and his work has thrown a flood of light on the chemical constitution of many of the more important compounds of nitrites. Truly, like Chevreul and Faraday, this great oriental savant has chosen research work in preference to money-making, and well has Professor Sylvain Levi of Paris remarked in the course of his review of the "*History of Hindu Chemistry*," "that his laboratory is the nursery from which issue forth the chemists of new India."

#### HIS STUDENTS AND THEIR RESEARCHES

Among those who have taken part in carrying on researches with Dr. Ray either as scholars, advanced students or voluntary workers, may be mentioned the names of

Jatindranath Sen, Premchand Roychand Scholar in Chemistry (now Professor at the Pusa Agricultural Institute); Atul Chandra Ganguli (now Professor of Chemistry, Ravenshaw College); Panchanan Neogi, Premchand Roychand Scholar in Chemistry (now Professor of Chemistry, Rajshahi College); the late Atul Chandra Ghose, M.A., who was appointed Professor of Chemistry in the Dyal Singh College, Lahore; Hemendra Kumar Sen, who has also won the blue ribbon of the Calcutta University in Chemistry on the strength of thesis alone under the new regulations; Jitendranath Raskshit, collaborator of Dr. Ray in the researches on the amine nitrites, etc., Rasiklal Datta, Nilratan Dhar, Manik Lal Dey and J. C. Ghosh.

The work of Rasiklal Datta makes a record in the history of chemical science in new India. While yet a junior 5th year student, the discriminating eye of his Professor singled him out to work in co-operation with him on the subject of the benzyl and allylammonium nitrites. Within an incredibly short time, he succeeded in preparing several compounds of this series, but he found time also to make independent discoveries of his own some of which are of surpassing interest. The discovery of a very large number of new compounds can be put to his credit.

No less brilliant have been the achieve-

ments of Nilratan Dhar in the domain of Physical Chemistry. Dr. Ray was seriously handicapped in his investigations on the nitrites for not being able to measure their electric conductivities and other physical properties. This young student almost in his teens, who had just won laurels in the B.Sc. examination, at once came forward for the relief of his teacher. Dhar's investigations on the conductivities of the nitrites as also the determination of their other physical constants are calculated to throw much light on their constitution. The brunt of the tedious work on the determination of the vapour density of ammonium nitrite devolved on him. Dhar has also published an elaborate investigation on the constitution of complex salts, based on Werner's Theory, for publication in the *Zeitschrift für Unorganische Chemie*. In reply to an address presented to Dr. Ray by the inhabitants of his native District—Jessore-Khulna—he thus bore testimony to the quality of the contributions of young Datta and Dhar:—

“As regards the numerous double of copper, silver, mercury, cadmium, etc., discovered by Datta, it is enough to say that I myself would have been proud to be their discoverer, but I am prouder still when I reflect that the discovery has been made by

a pupil of mine. . . . I look upon it as a manifestation of Divine Grace that a Rasiklal Datta or a Nilratan Dhar has at last been produced in the soil of Bengal." Dr. Ray has been heard to assert with some degree of confidence that Rasiklal Datta and Nilratan Dhar are fairly on the way to earning for themselves a European reputation as chemists. "Kshitihushan Bhaduri, Research Scholar, has been engaged in investigation on the active principles of some of the Indian drugs and his labours have already been rewarded by the isolation of some glucosides, *e.g.*, of 'andrographis paniculata.' He has also prepared some interesting compounds of acetylene with copper thiosulphate."

Hemendra Kumar Sen with Biman Behary Dey, M. Sc., has, in addition to his co-partnership with Dr. Ray, described a new method of the estimation of nitrites.

"An interesting method for the estimation of nitritic nitrogen by B. B. Dey and H. K. Sen depends on the use of hydrazine sulphate. When excess of the latter is allowed to act on a solution of any ionised nitrite, nitrogen, nitrous oxide and ammonia result.

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"If the reaction is allowed to take place in a nitrometer, the nitrous oxide may be removed by washing with water and the

residual nitrogen measured. The method has been successfully applied to some fifty nitrites, including tetramethyl ammonium nitrite and benzylamine nitrite, as well as the nitrites of the alkalis: alkali earths, and heavy metals. On the other hand, amyl nitrite, and in general non-ionised nitrites do not give rise to any evolution of gas when brought in contact with hydrazine sulphate."

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"The action of iron and nickel on the behaviour of hydrogen with various substances has been studied by Neogi and Adhicari. The authors were unable to confirm the statement of Ramsay and Young that iron was able to bring about some union between nitrogen and hydrogen, although reduced iron as well as iron wire were tried, and at varying temperatures and different degrees of dryness."—*Annual Report for 1911*.

Hemedra Kumar Sen and Priyadarajan Ray have also studied the interaction of hydrazine sulphate and ferricyanide of iron. The results of their researches have been published in the *Zeits. Anorg. Chem.* It was while continuing this work that Priyadarajan met with a terrible accident due to explosion of hot sulphuric acid. This young chemist who secured the first place in the M. A. examination in chemistry

has already shown all the capacities that go to the making of a chemist.

Haridas Sen, an M.Sc. student, has recently discovered an interesting compound, "zinosozincic chloride." He has also prepared in co-operation with R. L. Datta a remarkable series of double sulphates of barium and heterocyclic bases.

Saratchandra Jana, M.Sc., Research Scholar, has in collaboration with Dr. Ray determined the vapour density of "ammonium nitrate;" the patience, diligence and manipulative skill of a high order which he is bringing to bear upon the subject speak volumes in his favour. The following extract from Dr. Ray's recent address on the progress of chemistry in Bengal in 1916-17 contains an account of the work done by the latest recruits of his school:—

Last year has been altogether an eventful one. It may be a little more than a year. Three Doctorates have been conferred on our students. Dr. Rasiklal Datta is the first Doctor of Science in the Calcutta University in Chemistry. It is no breach of confidence and I am divulging no official secret when I say that in presence of our worthy Registrar (Dr. Bruhl)—I am afraid that is adding to the enormity of the crime—(laughter) one of the Referees to whom Dr. Datta's paper was submitted said that his work marked a record in Chemical researches in India. But I am placing myself under the purview of the official Secrets Act. Gentlemen, those who know Dr. Datta need not be told of the intrinsic value of his work. He has contributed some two dozen valuable papers and perhaps more. Then the Degree of Ph. D.



has been conferred on Professor Panchanan Neogi. Again the Degree D. Sc. of the London University has been conferred on Mr. Nilratan Dhar, and Dr. Bruhl had an opportunity of knowing him.

One of the most remarkable papers is that of Mr. Jnanendra Chandra Ghose. It will soon appear in the London Chemical Society's Journal. He is following it up with another paper. I may be allowed to say that it is a contribution which marks a new era in the subject, namely the Abnormality of strong Electrolytes. It is a remarkable paper. This is the subject in which Van't Hoff, Arrhenius, Ostwald and many mighty workers have racked their brain. But it was left to Mr. Ghose to work out the Law which gives full explanation of the phenomenon. His first paper covers about 9 pages but it has been followed by another of 18 pages and a third communication has also been made. These papers will throw a flood of light on one of the most interesting subjects in the domain of Physical Chemistry. To Dr. Nilratan Dhar also belongs the credit of being the pioneer in the field of Physical Chemistry in our land and of pointing out to our young enthusiastic friends the way to this fruitful line of research. Mr. Jnanendranath Mukerjee has published suggestive papers on Colloid Chemistry. Mr. Manik Lal Dey has just read a paper with experiments on a new phototropic salt. Its potentialities in the field of photography are obvious. These young scientists—the future hopes of our land—have kept up the fire and we expect many interesting contributions from them. I am not going to tire your patience by going into details of their researches. It is not my custom to take notice of any paper unless it has been accepted for publication in the leading Journals of Europe and America. We cannot afford to pass judgment on the work done by our own students unless it has received the stamp of the learned societies abroad.

Dr. Ray has attained fame and has rendered services to the cause of knowledge of which he and his countrymen may well be

proud. But he values no part of his work more than the training of the disciples who have been attracted to him by his magnetic personality. As we have seen, some of them have very early in life, and with limitations so numerous, won for themselves an international reputation. Like the true guru that he is, Prof. Ray deems these young workers in the cause of Science the richest legacy to bequeath to his country and the world. He observed in a recent speech at Madras that, talking of his disciples, he was reminded of the Great Mother of those immortal Romans who said that her children, the two Gracchi, were her richest glory. He quotes too with an exalted humility the ancient saying of our scriptures:

“Men should desire victory everywhere; but they should covet defeat at the hands of their pupils.”

Mr. F. V. Fernandez, a pupil of Dr. Ray, who is also joint author with him of an important research, has written an account of the “Indian School of Chemistry” from which we quote only the introductory and the concluding portions:—

“La chimie est une science française. Elle fut constituée par Lavoisier, d’immortelle mémoire”; thus began Wurtz his famous “Dictionary of Chemistry,” and at the time when this dogmatic assertion was made it seemed to require no word of apology from the author, so universally was the debt owed to the great

master recognised by the scientific world. Yet we find that, within a few years, dissentient voices rose and darkened the halo that was surrounding the name of Lavoisier. When men were loyal to the memory of their benefactors, Lavoisier was the creator of the science of Chemistry, the reformer who taught chemists new paths of inquiry, the founder of a school of mathematical exactitude. But the searching spirit of Germany has proved to its satisfaction that the Frenchman was only a recogniser of chemical doctrine whose "great achievement consisted in abolishing old prejudices and in the masterly application of scientific principles to the explanation of chemical processes." This is about all the credit which Lavoisier gets at the present time in some of the German schools.

If such is the fate of one of the greatest master minds of the world, what judgment can we expect from the future on the work of the Hindu savant, who has revived the scientific traditions of his country? He is not a Lavoisier, and yet through his efforts the land of Nagarjuna has renewed activities which lay dormant for centuries. It was that savant himself who bitterly deplored the "intellectual torpor and stagnation" of his country; and there was left to him the noble task of regenerating Indian Chemistry. It is he who, to the nation of metaphysicians and visionaries, has added the lustre of a school of experimental and inductive scientists. The man who has accomplished these things cannot be ignored by his countrymen. India offers the tribute of respect to her illustrious son, the founder of the Indian School of Chemistry, Professor Prafulla Chandra Ray.

Such is the history of a great scientific movement in this country. The leader has carried out his life's mission. He has founded the School. He has trained a host of chemists. And now he may rest fully assured that the work he has started will be carried on in all its details. The development of the School he has created he may now safely trust in the hands of his pupils. They will prize it as their most valuable legacy, and loyally hand it down to posterity.

What an awakening for India! After centuries of

scientific stagnation she has now recovered her former position in the chemical world. May the man who has effected this change be long preserved to us! May he long inspire his disciples to greater deeds! All we can do now is to pay a sincere tribute of affection, of admiration, of respect to the great benefactor and disinterested philosopher, Prafulla Chandra Ray.—*The Presidency College Magazine.*

#### DR. RAY ON SOCIAL REFORM

In admiring Dr. Ray as one of the greatest scientists of the present age we ought not to forget that his life has not been lived altogether within the recess of his laboratory. Dr. Ray is a patriot, and his patriotism has the ring of sincerity which is only natural in one whose life has been a dedication to the service of knowledge and the search for truth. His contributions to Science, while enlarging the bounds of knowledge, have conferred honour on his race. His work on the history of Hindu Chemistry is an undying monument to his patriotism as, through it, he has raised his country in the estimation of the world. Besides a scholar and patriot, Dr. Ray has also been a warm social reformer. His countrymen marked their appreciation of him by voting him to preside over the Indian National Social Conference of 1917 held at Calcutta. Dr. Ray, all unconscious of how he would be misrepresented by interested political factions and only alive to the great social malady in the body politic,

asked in the course of his much-discussed address:—

While the echo of *Swaraj* or Home Rule is reverberating from one end of the country to the other,—while ambitious schemes of political re-construction are being propounded by every section of the people—while gorgeous visions of a United India are capturing our imagination—loud protests of indignation are raised by classes and communities amongst us which we can no longer ignore. Why is there this note of discord where there should be only peace and harmony? Why this rift in the lute?

The answer lies in a nut-shell. It is our failure to recognise that the question which presses for solution at the present moment is as much a political as a sociological one. By the nature of things it must be so. For, however much we may try to divide and isolate the various parts of the national problem, they cling to one another as fast as ever and mock our attempts at self-deception. We cannot, with impunity, give undue preference to one over others. The law of *Karma* or causation is inexorable, and our past neglect in the work of social reform is bearing its evil fruit at the present hour. It has begun to clog the wheels of political progress. . . . .

Talking of “touchability and untouchability,” he could not but speak in strong language:—

What was possible in Japan in 1871 is found to be impossible in India even towards the close of the second decade of the 20th century. Even now we find that, as the saying goes, 12 Rajputs meet have 13 cooking pots and 500 Congress delegates require as many kitchen arrangements. This at any rate is applicable to our friends of the Southern Presidency, who have worked out the problem to metaphysical nicety inasmuch as they have added a new category of contamination by sight of the cooked food of a Brahman when seen by a member of the Panchama

class even from a distance, say by means of a telescope.

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The problem of "touchableness" has assumed a scientific aspect in these days. If a Pariah crosses your threshold you throw away your jar of drinking water as polluted, but ice and lemonade manufactured by the untouchables pass current! A distinction conferred on a member of our society becomes the occasion for giving a dinner in the Town-Hall catered by Peliti and the recognised leaders of the Hindu society take part in the function and their names are published in the morning papers, but when on the occasion of a marriage or *Sradh* you are guilty of sitting to a feast with a Christian or Moslem or even a Hindu of the *lower* castes you are threatened with excommunication. Reason, logic and common sense are thus scattered to the four winds.

#### DR. RAY'S POLITICS

These views created some sensation at the time and his friends and foes thought him to be a bit reactionary in politics. His address at the Social Conference was a frank expression of the indignation which every Indian must feel at the iniquities of our social system. But it is not fair to conclude, therefore, that Dr. Ray is inimical to the political interests now dominating the country's mind. He has himself admitted the need of some far-reaching measure of reform. If in his address at the Social Conference he desired to create a body of public opinion to bring about at least a mitigation of the prevalent social evils, he did not certainly mean to be a derisive influence.

On the contrary, he is passionately opposed to doing anything which would impair national solidarity and has strongly deprecated the tendencies, wherever found, in the conduct of whatever party it may be, of weakening such solidarity. His remarks on Sir William Wedderburn, made at a memorial meeting held at Calcutta, are sure to be of interest in this connection:—

The ultimate moral justification of England's rule over India is not *Pax-Britannica*, not even the economic prosperity of the country, but the preparation of Indian people for Self-Government. If that end is lost sight of in the pursuit of any subsidiary advantage or improvement, the British policy in India will miss its true goal. Its history will be a record of huge failure, a record of immense preparations without the fruition. Sir William knew it, and, therefore, he kept his gaze steadily fixed on the true end and aim of England's mission in India, however distant that end might appear to his contemporaries, and he was only one of the noble band of Englishmen who have devoted their lives to the same cause. He was "ain brither" to Henry Lawrence and Evans Bell, Henry Cotton and Allan Hume. Such lives may seem to the shortsighted materialist, to the all-wise practical politician and experienced bureaucrat on the spot as futile. But only such lives can build a bridge between East and West—only such Englishmen can make India's inclusion in the British Empire possible. When centuries have rolled away from now, when the divine purpose has wrought itself in India and the final history of our land comes to be written, the names of Wedderburn and Hume will shine in that record as a silver thread shot through the crimson web of the British conquest of India.

#### UNIVERSITY LECTURES

In February 1918 the Madras University

invited him to deliver a course of lectures on Ancient Hindu Chemistry. Dr. Ray's addresses, it need hardly be said, were very much appreciated by his audience. It is characteristic of the selflessness of the man that, with the honorarium which the University paid to him, he endowed a prize in memory of the late Sir William Wedderburn to be awarded to the student who showed the highest capacity of scholarship or research in chemistry. The lectures of so great and original a savant must have the salutary result of stimulating research in a University which has done so little in this very necessary direction. Dr. Ray explains the difference between the Universities of Madras and Calcutta in the matter of research in these words in an interview published in the *Hindu*:—

#### RESEARCH IN MADRAS

In view of these high attainments of Dr. Ray, I asked him why Bengal was more advanced in research work than Madras and in what ways we could bring about development in research in this Presidency. "In the first place," said Dr. Ray, "we had in Bengal the Hindu College, latterly known as the Presidency College, staffed by Europeans and Indians, interested in research and invested with full control over well-equipped laboratory. In the second place, we have, mainly through the munificence of Sir Taraknath Palit and Dr. Sir Rash Behari Ghose, a University College of Science to which the Government of India



is expected to make a handsome grant. The fact that Sir Sankaran Nair is the Education Member of the Government of India and that Sir. S. P. Sinha is in charge of the Education Portfolio in Bengal leads us to feel hopeful of that measure of Government support which are warranted under the circumstances. In the third place, we Indians in Bengal have—our researchers included, who are growing in number,—a larger measure of control over education than you have here and the scope for free and unfettered development is consequently greater. Above all, public opinion, able to make itself felt, is solidly behind researchers who are growing alike in number and in importance." "As for Madras," Dr. Ray continued, "you must first of all create an atmosphere of research and this cannot be done unless you have a dozen or so of men who have secured European reputation by solid contributions to the advancement of science. If you produce more men like Mr. Ramanujam and appoint them professors of your colleges, then they will perforce be allowed to have free scope for development along lines which they themselves choose. As a first step, you might send your students to England. As regards chemistry students, you might in the first instance send them to Calcutta. Then, as in the case of the Palit Professorships and Lectureships, you must lay down a rule that none but Indians should be appointed to high posts such as these, so that you may be sure that Indians of note, who are growing in number, shall be encouraged in their efforts to make researches with advantage to the country. Granted these conditions, strong, effective public opinion and support, and well-equipped laboratories, there is bound to be steady development". Dr. Ray spoke with feeling when he referred to qualified Indians being kept out of higher posts. He regretted that the Tatas sometime ago gave room for complaints that they did not fully encourage the appointment in their Institute of qualified Indians, but added that he believed that the mistake had been found out and matters would be improved. Our aim should be, he said, to create a set of qualified, self-reliant scientists and this could not be done unless we give opportunities of training for our promising youths.

## HIS METHOD OF STUDY AND WORK

The question may arise: how a confirmed invalid or valetudinarian for the last 44 years has been able to do so much in so many different spheres of activity. The answer lies in a nutshell—Dr. Ray believes in doing one thing at a time and doing that well—he has been heard to say that it is concentration of mind that pays and not the number of hours devoted to study—he cannot read more than one hour at a stretch and that in the morning as his brain gets easily fatigued—but he is an embodiment of order, method and punctuality. Dr. Ray's latest pronouncement is that his appetite for chemical researches simply grows by what it feeds upon: he is author or joint-author with his pupils of some four scores contributions chiefly on the nitrites and it was in the fitness of things that Prof. Armstrong should style him "Master of Nitrites." Since joining the College of Science, *i.e.* within a space of a year and a half, he has communicated to the Chemical Society of London half a dozen papers and the "Annual Report on the Progress of Chemistry" to hand gives a summary of three of his latest researches. Work at the Laboratory is his delight and so long as he is inside his *sanctum* he forgets all about the outside world—if he passes a single day without learning something new or adding something to the stock

of knowledge he grieves like Titus, "Oh Friend, to-day I have lost a day."

### HIS CHARITY

Mr. Padmini Mohan Neogi, writing of him in the *Indian World*, speaks of his philanthropy in these feeling words:—

We who have had occasions to know the influences that are working upon young Bengal, can make bold to anticipate that his goodness, his charity and inspiration if nothing else, will ever be a household topic from the centre of the metropolis to the distant corners of Bengal where the benign torch of education has been carried. Uneventful as his life has been, free from the bustle of the pompous follies of society, single in his life, his is yet an eventful life—events not like the passing of a bill in a legislature, or the foundation of a memorial institute, or a bountiful donation for a Rai Bahadurship, but simple tears of orphans, of aspirant but indigent youngmen, of the high or the low or the warfare of an acid with a metal or the friendship of an acid with a base. How often have we seen wretched youngmen, wretched on account of poverty, going up into his laboratory room where they laid bare their heavy bosoms, and he the father of them all, fondling with all the affection as though they were his own. We have heard him say many a time and oft that poverty is a rigid school and the sessions are long and bitter; but the men and women who graduate therein come forth with physical frames capable of enduring fatigues, with hearts habituated to disappointments, and fortified against the rebuffs of fortune, with intellects trained by patient, laborious and unbending application. What an intolerable chain it binds around aspirant souls! And yet the world's greatest thinkers have felt this iron in their flesh and bursting the galling bonds, have carved their way to eminence and immortality. Though himself a prodigious man of charity (for which his friends have sometimes taken him to task), his opinion

regarding money-saving has been but simple. Of all charities, he often says, mere-money-giving is the least; sympathy, kind words, gentle judgments, a friendly pressure of weary hands, an encouraging smile will frequently outweigh a mint of coin. Bear this in mind, we have often heard him say, selfishness is the real root of all the evil in the world; people are too isolated, too much wrapped up in their individual rights, interests and enjoyments. The first person singular is the God of the Age.

### CHARACTERISTICS

Severely simple and ascetic in disposition, Dr. Ray has given the best part of his life to build up character among his students and inspire them with the love of knowledge for its own sake. He may have had his disappointments, but he has done more to inculcate the wisdom of plain living and high thinking than perhaps any other man now living in Bengal. A few racks of books, a miserable-looking and antiquated bedstead, an eighteenth-century table, with a few old-fashioned chairs form all his earthly belongings; and though he has been to England thrice, he has acquired none of the arts of grace and fashion of modern life. His dress is simple and his personal appearance seems so neglected. It has been often embarrassing to his visitors to recognise the man whose greatness had induced them to catch a glimpse of him. The striking sketch of him by Mukul Chandra De is a marvellous pictorial reproduction of the unpretentious scientist with eyes seeing deep

into truth through all the veils of illusion and concealment.

Dr. Ray, having been single all his life, has not had many charges on his purse and no serious financial obligations to discharge. Almost all that he earns as a professor or as profits from the Bengal Chemical and Pharmaceutical Works, he spends on poor boys, deserving institutions and charities. It is difficult to spot out many poor boys in the Calcutta colleges who do not receive some help or other from this philanthropic professor, and there are very few deserving charities in Bengal that do not count him as their patron. Indeed, behind an unpretentious and attenuated figure—Dr. Ray has been a confirmed dyspeptic for over 44 years—he carries a heart as warm as the climate of his native land.

Absolutely oriental in habits and tastes, there are very few men in Bengal who have drunk so deep of Western knowledge and who have been so strong and steadfast champions of right thinking and right doing. A devoted and careful student of Mill and Spencer, Dr. Ray is a rationalist to the very core of his heart. He seldom allows his emotions or the prejudices of his environment to get the better of his judgment. He does not believe in caste or communal ideas and, though a member of the Brahma Samaj, is far from

thinking that that church can claim any monopoly of any moral and spiritual wisdom. He hits as hard in private life against Hindu practices as against Brahma pretensions. About eight years ago he contributed to a vernacular periodical of Bengal an article in which he boldly came out with chapter and verse to prove how the Bengali intellect, or, for the matter of that, Indian intellect, had suffered through foolish customs and absurd religious prejudices.\*

Prafulla Chandra Ray is not only one of Bengal's greatest sons but is also one of Nature's truest gentlemen—every inch of him. Though a man of very strong convictions, he has hardly made an enemy in his life. He has held aloft the banner in Bengal of Mathew Arnold's culture and sweet reasonableness. He cherishes no jealousy, entertains no malice. Even when he differs from anybody, he imputes no motives nor attempts to throw any mud at his opponents. He is frankness and cordiality almost to everybody, and never plays with any cards in his sleeves. When he fights, he fights with gloves off. In all his private and public dealings, he is most scrupulously honest and above board. He believes in a clean and pure life and has himself lived

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\* For full text of the article see "Essays and Discourses" of Dr. P. C. Ray, G. A. Natesan & Co., Madras.

up to this ideal. Sparing as an eater, a talker and correspondent, he has not allowed many distractions to disturb the even tenour and equanimity of his life. The work in the laboratory is certainly the most fascinating and engrossing work of Dr. Ray's life, but, besides a scholar and savant, he has also many social attractions. He has a warm corner in his heart for many friends to whose homes he pays regular visits and with whom he always keeps himself in intimate touch. Not very infrequently, he goes about begging from the house of one such friend or other for either half a piece of a cake or some home-made sweets or some other delicacies, and the ladies of these houses take a special delight in providing him with "good grub." Among others, with whom he has maintained life-long friendship and in whose homes he is always received with open arms, may be mentioned the names of Sir J. C. Bose, Hon. Dr. Nilratan Sircar and Messrs Satyananda Bose and Prithwis Chandra Ray. There is another set of friends with whom he makes a point of passing about three hours every evening in the spacious maidan flanking Chowbrigghee Road (Calcutta). Being almost a lifelong victim of dyspepsia and a bad nervous system and being troubled with insomnia now and then, Dr. Ray has found life and health and recreation in the religious observance of this

evening programme. Every evening, in cold and heat, in rain and summer, Dr. Ray is found squatted on the grass of a quiet corner in the maidan with a number of friends agreeably occupied in the pleasant pastime of "chronicling small beer." Some of these friends are Principal Giris Chandra Bose, Kaviraj Upendranath Sen, Mr. Satyananda Bose and several of his own students and fellow-workers in the laboratory.

#### CONCLUSION

Dr. Ray will rank in our history as one of the greatest of those who have helped in building up the edifice of modern India. His name stands along with that of Sir J. C. Bose as evidence of the genius of the Indian mind for scientific research. It is the most hopeful sign of our renaissance that it is not confined to one or two aspects of life only but is universal and all-embracing. The wave of new life has pervaded every nerve, vein and muscle of the national being. On the side of Science and Research, the achievements of P. C. Ray and J. C. Bose represent the high water-mark of the national genius. Others have achieved eminence in other fields. But to these belong, in a special measure, the honour of living up in a materialistic age to the grand ideal expressed in the words of one of them :—



*Not in matter, but in thought, not in possessions or even in attainments but in ideals are to be found the seed of immortality. Not through material acquisition but in generous diffusion of ideas and ideals can the true empire of humanity be established.*

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# ESSAYS AND DISCOURSES

BY

DR. PRAFULLA CHANDRA RAY, C. I. E.

This is a comprehensive collection of the writings and speeches of Dr. P. C. Ray, the well-known Indian chemist. At the request of the publishers, the papers collected for the first time in this volume have been selected and revised by Dr. Ray himself. Appropriately enough Dr. Ray's contributions on Scientific Researches and Hindu Chemistry in particular find precedence in this collection. The volume opens with a paper on "The Problem of Scientific Education in India" written as early as 1889 in the pages of the *Calcutta Review*. Among other papers in this section are "Progress of Chemistry in Bengal," "Possibilities of Chemical Industries in India," "Higher Science in the Universities," "Chemistry and Medicine" and the special lectures on "Hindu Chemistry" delivered by Dr. Ray in February last at the Madras University. This is followed by papers on Education and Industries—Dr. Ray's evidence before the Royal Commission on Public Services, on the Educational Services as also before the Indian Industrial Commission in 1917. Dr. Ray's thoughtful article on "Bengali Brain and its Misuse" which had provoked a great deal of discussion in the Indian Press in 1910, his presidential addresses to the Bengal Literary Conference and the last Social Conference at Calcutta, are also included in this volume. Then follow Dr. Ray's appreciations of the late Ananda Mohan Bose, Dadabhai Naoroji and Sir William Wedderburn. The appendix contains a complete list of the researches of Dr. Ray and his pupils. The volume is bound in Cloth.

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