he also became, and remained during life, a governor of that college. He was elected President of the Manchester Statistical Society, and held the office for two years, 1865–67. He was afterwards first President of the Manchester Institute of Accountants; and on its absorption by the newly Incorporated Institute of Chartered Accountants in London in 1880, he was nominated as a member of council, a seat which was only vacated with his decease. In addition to the Papers already referred to, he was the Author of several essays on Parliamentary representation, poor rates and principles of rating, profit sharing, and joint stock companies. He visited the United States and Canada five times, and he also travelled extensively in parts of Europe, and made one visit to Egypt and Palestine.

In 1878 Mr. Chadwick married, as his second wife, Ursula, eldest daughter of Mr. Thomas Sopwith, F.R.S. After passing his seventieth year, the indications of diminished vitality were clear, accompanied as they were by impaired sight and increasing deafness. His last illness was mercifully brief. Returning home from a visit to the sea-coast, he was stricken with paralysis, which rendered him speechless. After three days' illness he died at his residence, the Poplars, Herne Hill, early on the morning of the 19th of September, 1895, in the 74th year of his age. Mr. Chadwick was elected an Associate on the 23rd of May, 1854.

THE death of SIR ROWLAND MACDONALD STEPHENSON removes from the Roll of the Institution the name of a man who, on several grounds, is entitled to an exceptional place among the biographical notices which are issued of its deceased members. He had arrived at a ripe old age, and was at the time of his death what is called "the father of the Institution," *i.e.* the person whose name had been longest on the books, having been elected on the 1st of March, 1836. He was not a "Member" in the strict sense of the word; for though he had qualified himself for the engineering profession, the use he made of his engineering knowledge was not to practise in detailed construction, but a far wider one, namely, to promote and spread the work of the engineer over the most gigantic areas of the habitable world. The Council would have had ample justification in classing him among the full Members, but he never desired to change his grade, and so

he remained an "Associate," as he was elected, to his life's end. The governing body has, however, in this notice, the opportunity of acknowledging the value of his services to the profession, which it most willingly does.

His career was in some respects analogous to that of the late Honorary Member, Ferdinand de Lesseps; for as "Le Grand Français" devoted successfully his best energies to the work of the Suez Canal, so the subject of this memoir occupied the best part of his life in the establishment of the great system of railways in India, which he lived long enough to see carried into full development. And, to follow out the analogy, as the obituary notice of M. de Lesseps[1] necessarily comprised a general history of his great undertaking, so it will be desirable here to enter into some detail as to the origin and progress of the Indian Railways, of which Sir Macdonald Stephenson (as he was usually called) may truly be esteemed the Founder.

He was a descendant of a family long settled in Cumberland and Westmoreland, its residence in those counties being traceable since 1538. He was born in London on the 9th of June, 1808, and was educated at Harrow. He entered a banking house with bright prospects, but the failure of the firm in 1828 compelled him to look for other employment, which he obtained from one of the great engineering establishments in Staffordshire, the "Gospel Oak Ironworks."

His first occupation was as their London agent, and there is no reason to suppose that, previous to that engagement, he had any experience in work allied to the profession of engineering. But this was the period of the beginnings of railways, and young Stephenson must, from his position, have heard of the doings of his great namesake. Indeed, the impulse that the railway movement was giving to engineering factories must have been felt by the firm with which he was connected, and he was thoughtful enough to try to turn this to his own advantage.

He assiduously studied the nature of the business which passed through his hands, and he supplemented this practical process by devoting his evenings to the acquirement, under experienced teachers, of mathematical and other scientific knowledge, and to the careful perusal of the best engineering works he could find, with the view of becoming an engineer. After this preparation he

[1] Minutes of Proceedings Inst. C.E., vol. cxix. p. 371.

appears to have passed a further time at the works themselves, which enabled him thoroughly to master the mechanical details and routine of engineering manufacture. There is no doubt that the years spent in this way formed a fairly sufficient qualification to enable him to become a practising engineer, had he been disposed to do so.

But he probably felt the desirability of some fixed income, for in 1838 he accepted the post of Secretary to an Association called "The Comprehensive Company for establishing regular Steam Communication with India." It is unnecessary to notice this society further than to say that it ultimately resulted in the formation of a more important body, which has now attained world-wide celebrity, namely the "Peninsular and Oriental Steam Navigation Company," of which the original Charter of Incorporation was dated the 31st of December, 1840.

There can be little doubt that the connexion of the mechanical element with the business of these undertakings formed an attraction to the young man, and it is certain that their great object, namely communication with India, first set his mind on the opening there was in the East for European engineering.

But while Mr. Stephenson was engaged in this matter he did not allow his engineering knowledge to lie unused. He happened to be fond of the drama; and in visiting the theatres, he was struck by the complicated arrangements made for the scenic preparations and changes, which appeared to demand much labour and the services of many men. It occurred to his mechanical mind that much of this complication and labour might be saved, and he devised a most comprehensive and ingenious plan for effecting the object by machinery. It was described, with a complete set of drawings, in a Paper[1] read before the Institution on the 8th of June, 1841, but it does not appear ever to have been put in practice, probably because more important objects about that time began to occupy his mind.

Sir Macdonald's connexion with the steam-boat transit to the East appears to have furnished the stimulus which set him upon the great work of his life. He had clearly come to the conclusion that improved means of communication formed the most valuable instrument which could be employed for spreading civilization, and extending the trade and prosperity of England; and having

[1] Minutes of Proceedings Inst. C.E., vol. i. (1841) p. 153.

succeeded in bringing India into closer union with Great Britain by an improved sea passage, he saw, earlier and more clearly than any one else seems to have done, that there was a grand opening for the introduction, into that far-off but great empire, of the new system of land transit which was now effecting such wonders in the home country.

As early as 1841–2 he, having already access to the East India Company and the Board of Control by his steam communication business, broached the subject to them, and urged powerfully on them the extreme desirability of taking steps for the introduction of railways, which, he said, were more urgently needed in India than in more civilized countries; and which, he declared, would transform the most costly, slow and uncomfortable, into the cheapest, most rapid and most convenient method of transport in those widely-spread states. But though he unceasingly pressed the subject upon the authorities, he made little or no impression upon them. They hesitated to embark in what appeared to them a grave risk, and replied, in support of their objections, that white ants would destroy the timber sleepers; that constantly recurring floods would wash away the embankments; that rank vegetation would choke the line; and that the natives would certainly never travel by the railway, even if it could be made and maintained.

Mr. Stephenson's only comment upon these imaginary difficulties was, that in 1843 he gave up all work he was engaged on in England, and went out, with his wife and children, to India, where he resolutely determined to remain until he had effected his object, or at least had impressed its advantages on the authorities.

Soon after arriving in Calcutta, his talents having attracted attention, he was asked to undertake the editing and management of the leading daily paper, *The Englishman*, and gladly accepted the task, as offering considerable facilities for his plans. In January, 1844, he published an article explaining his views, illustrated by a large map of India, showing the whole system of lines which he held to be most suitable for the country.

The Governor-General, Lord Ellenborough, who regarded the scheme as visionary, gave no encouragement to it; but, on his recall, Mr. Wilberforce Bird (the acting Governor-General), and Sir Frederick Halliday (late Lieutenant Governor, but then Secretary to the Government of India), appreciating the value of

such a project, Mr. Stephenson wrote, on the 15th and 20th of July, 1844, two official letters asking the straightforward question whether, and to what extent, the co-operation and support of the Government would be granted, in the event of one or more lines of railway being undertaken by private capitalists. Sir Frederick gave an answer generally favourable, and at once published the correspondence with Mr. Stephenson in the Government Gazette "as a matter of great public importance."

Mr. Stephenson thereupon returned home, and on the 26th of November published a report, addressed to Mr. Wilberforce Bird, giving a full account of all that he had done in the matter while in India. A few extracts from this, the first important publication on the subject, will show its general nature.[1] He says—

"The development of the resources of British India had engaged my attention for a period considerably antecedent to my visiting that country, by which I was enabled to confirm by personal observation and enquiry the impressions previously entertained on the subject.

"Among my first endeavours to accomplish the object in view, in a country in which the construction and uses of a railway were scarcely known, I from time to time published, in the Native as well as in the English local journals, the reports of the various European railway companies, with statements of their expenditure and income, the traffic in goods and passengers, as well as the general effect which has been observable in every district through which a line of railway has been laid down. By these means the public mind became familiarized with the operation and advantages derived by other countries from the application of this mode of transport, which has already induced a strong and decided feeling in favour of the early introduction of similar measures in India.

"With a view to provide the necessary materials for duly estimating the relative advantages of the different lines on which, from the known extent of trade, it appeared probable that a railway would prove remunerative, I commenced a series of papers . . . which I purpose to complete hereafter.

"The time having, however, arrived for imparting to the subject a more practical and substantial form . . . I have been induced to recommend that a commencement should be made . . . without delay.

"I would also recommend that the proposed Company should be incorporated under the title of the East India Railway Company, with a view to their carrying out in succession the several lines of railway in India."

Early in 1845 a formally drawn up prospectus for the Company was put before the Court of Directors of the East India Company; and after many discussions the Court addressed, on the 7th of May, a despatch on the subject to the Governor-General, which formed the beginning of a correspondence between the Home and the Indian

[1] This Report is in the Library of the Institution.

Governments of great length and complication. As a practical measure, however, the Directors came to the conclusion that it would be advisable to send out to India a railway engineer of experience, who, in conjunction with two Indian officers, would, after due inquiry, suggest some scheme of moderate length as a first experiment. The engineer appointed for this purpose was Mr. Frederick Walter Simms,[1] who arrived in India in September 1845.

This measure was due chiefly to the influence of Mr. Stephenson with the Directors, and he accompanied Mr. Simms to India with a small staff to aid in the surveys.[2] It was his hope that Mr. Simms would disabuse the minds of the Directors of the engineering objections that had been made against the railway system. Mr. Simms sent in a memorandum in February, 1846, and this was considered and discussed by the Government of India (then under Lord Hardinge), along with a report of a "Committee of Engineers," who recommended the construction in the first instance of a line from Calcutta towards Delhi. Early in

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[1] Minutes of Proceedings Inst. C.E., vol. xxv. p. 519.

[2] It is right to say that, while Mr. Stephenson was earnestly promoting railways in Bengal, two other engineers were repeating his endeavours in the other Presidencies, namely, Mr. Heath in Madras and Mr. Chapman in Bombay. In the latter place, the East India Company, with a view to the increased prospect of public engineering works in India, had, in 1844, formed an engineering class in the Elphinstone College, and had, on the recommendation of this Institution, sent out Mr. William Pole (now its Honorary Secretary) to take the direction of it. And it is curious that exactly at the time when Mr. Simms was engaged with Mr. Stephenson in his earliest surveys, Mr. Chapman, in Bombay, had engaged Mr. Pole, with the aid of his college class, to make a survey for what afterwards was "The Great Indian Peninsula Railway." The following letter from Mr. Chapman may serve as a record of the first practical step taken towards the now great lines in Western India:—

Railway Office, Bombay.
23 *Feb.* 1846.

To WILLIAM POLE, Esq.

MY DEAR SIR,—It has become necessary to make arrangements for levelling the line of the proposed railway from this port to Tannah. Will you be so good as to inform me whether (from your class of Civil Engineering in the Elphinstone Institution or from any other quarter) you are aware of any suitable and efficient help for that purpose which can be obtained, and if any such be within your knowledge what measures will be necessary for obtaining it.—Yours very truly,

T. CHAPMAN,
Manager Great Indian Peninsula Railway Company.

1846 Mr. Stephenson returned to England, having completed his survey, on which he also made a report,[1] describing his selection of a line.

In December, 1846, the Board of Control communicated its views to the Court of Directors, and further discussions followed at considerable length (chiefly on the terms to be granted), until August, 1849, when the Honourable East India Company formally engaged in a contract with the East Indian Railway Company for the construction of an experimental line, at a cost not exceeding one million sterling. About this time Lord Dalhousie had succeeded Lord Hardinge as Governor-General, and took great interest in the railway undertaking, making several alterations which he considered beneficial.

In the meantime Mr. Stephenson had not been idle. He went to India in 1847, returning to England in 1848, and in 1850 he went out again to supervise the actual construction of the line, for which he took out a complete and efficient executive staff. This was under the control of an eminent and experienced Chief Engineer, Mr. George Turnbull,[2] who remained at his post till the opening of the line to Benares in 1863.

Mr. Stephenson had selected as the preferable route the line from Calcutta, crossing the Hooghly river about 20 miles above that city, and continuing the direct course to Benares as the main or trunk line (to which branches might be made later on) and to Agra and Delhi. The Government of India, however, adopted the circuitous route bordering the Ganges; and some years later the correctness of Mr. Stephenson's views was acknowledged and acted upon, by the addition of the "chord line" on the alignment which he originally recommended.

The construction of the railway was now prosecuted with vigour. Mr. James Meadows Rendel[3] had been appointed the Consulting Engineer in England, and the immense provisions of ironwork and apparatus required were designed by him, and manufactured under his superintendence;—a work in which he availed himself, until his death in November, 1856, of the assistance of Mr. W. Pole.

On the 3rd February, 1855, the first portion of the line, 121 miles from Calcutta towards Delhi, was opened by Lord Dalhousie,

[1] This Report is in the Library of the Institution.

[2] Minutes of Proceedings Inst. C.E., vol. xcvii. p. 417.

[3] *Ibid*, vol. xvi. p. 133.

the occasion being celebrated by a public breakfast at Burdwan. Lord Dalhousie had taken up the subject with an earnest determination that the country should no longer lack an element of strength and prosperity which was within grasp, and his exhaustive and valuable Minute of 20th April, 1853, addressed to the Home Authorities, terminated all difficulties and objections.[1] The further progress of this great undertaking is matter of common knowledge, and need not be described here. In 1857 occurred the memorable Indian Mutiny, with all its attendant horrors. It caused delay to the construction of the railway, and threw many of the persons engaged into difficulty and danger. One episode in this dreadful history deserves mention, namely, the heroic defence of Arrah, by Mr. Vicars Boyle (now C.S.I.), the engineer in charge of that district, which saved the lives of many gallant soldiers and civil inhabitants of the station.

Mr. Stephenson, however, escaped this danger. In 1856 his health gave way under excessive mental and physical strain, and he left India for a few months' thorough change, but he was prohibited, under medical advice, from returning, and thenceforward remained in London. On taking leave he received a valuable testimonial in India, with a strong expression of the obligation the country was under to him. H.M. Government recommended him to the Queen for a knighthood, which was graciously bestowed upon him; and the shareholders, sensible of the services which he had rendered, and of his entire disregard of all interests except their own, presented to him, out of the surplus earnings of the line above the guaranteed 5 per cent., a provision of £2500 a year for the lives of himself and his wife, by the commutation of which he was enabled to make provision for his family. The following passage from the address of the chairman, Sir Richard Strachey, to the first meeting of the company after Sir Macdonald's death, will show the estimation in which he was held:—

"I regret, gentlemen, to have to commence the observations I am about to make to you with a reference to the death of one whose name, Sir R. Macdonald Stephenson, has been associated with that of the East Indian Railway from the time of the movement which led to the formation of our Company, for which we must look back for half a century; who for many years took a leading part, first in its construction and management in India, and subsequently became a Director of the Company, holding the position of Deputy Chairman until 1888,

[1] This Minute is in the Library of the Institution.

and finally retiring from the Board, in consequence of his very advanced age, in 1892. It does not fall to the lot of many to find their anticipations of success so fully realized as that achieved by the great Undertaking, to the initiation of which Sir Macdonald Stephenson's perseverance and energy so largely contributed; and the share he had in that result should always be remembered by those who, like ourselves, are carrying on the work in which he so long participated."

The qualifications which contributed to Sir Macdonald's success in his great work have been happily commented on in a notice published shortly after his death, from which some extracts may conveniently be given here.[1] The writer, who knew him well, says, speaking of his return to Calcutta to prosecute the making of the line:—

"With feeble health, and no knowledge of any native language, he sat for years rarely stirring out of his office, driving with the energy of five men the vast concern. There were difficulties with the Government, difficulties with the native landlords, difficulties with the contractors, and, twice at least, any other man would have retired dead beat; but Macdonald Stephenson never lost heart or patience or temper with any obstacle. He wrote with a certain difficulty, in a queer way, and he was a little intolerant of fools; but he had always a plan, and always, when dealing with officials, an infinity of persuasiveness. He became the very soul of the undertaking, every engineer under him (and he had one man of genius and many able men) knew he could rely upon support, and however great the difficulties, he demanded that the work should go on, that nobody should talk of impossibilities, that non-existent labour should be imported, and that the indispensable class of minor contractors, who did not exist and could not be imported, should be created out of the ground; and so the road rolled on till it reached Delhi."

It may be added that he had self-reliance almost to a fault; but it was this which carried him through against all obstacles. And he moreover was favoured by a physical peculiarity, namely, that he was an exceedingly ready and sound sleeper, which enabled him to carry on his work in that climate when others less gifted would have succumbed.

Mr. Stephenson's success on the East Indian Railway induced him to extend his ideas, even beyond the gigantic area which had yet occupied him. He reasoned that when India had become covered with a network of railways, it would still be a long way from Great Britain, with which it had so indissoluble a political connexion. He had studied the mode of communication between the two, and found that, shortened as it had been by the passage

[1] "Spectator," 30 November, 1895.

through Egypt, the journey must always occupy weeks by sea transit. And it occurred to him that, since there was an actual stretch of *terra firma* between India and the English Channel, the construction of a railway along that land would reduce the weeks of transit to a few days. In other words, the dream of his life was not only to found an Indian Railway system, but to beat M. de Lesseps on his own ground, by opening a direct railway line from Calais to Hindostan.

This idea seems to have presented itself to him in a feasible form at an early period while he was engaged in the construction of his line. On the 1st of January, 1850, he addressed a communication to Lord Palmerston, then Minister of Foreign Affairs, with a map illustrating the further extension of Railway enterprise, by which the East and the West—India and all Europe—could be placed in direct communication by a seven days' journey. He showed the practicability, the economical cost (if honestly carried out), and the immense results to Europe and Asia, of such a project; and he informed Lord Palmerston he would endeavour to obtain the co-operation of all the foreign States; that the work should be international; that all the States it passed through should contribute more or less; that all should participate in the benefits of the necessary contracts, and that all should co-operate by local committees in the administration and working of the project. He received at once, from Lord Palmerston, letters of introduction to the Courts of Europe, and his applications were received by them all with consideration and cordiality.

He persevered for years. In March, 1855, he sent to Lord Palmerston a summary of the state of the case, and in January, 1856, Lord Dalhousie gave him, on behalf of the Government of India, an approval of his plan and a promise of assistance therein.[1]

But the time was not ripe. There were international jealousies without end, capitalists shook their heads and asked for impracticable guarantees, and nothing appears to have come of the project, except that, in 1857, the interest manifested by Mr. Stephenson in railways through Turkey, led him to accept the chairmanship of a line then being constructed from Smyrna to Aidin, afterwards called the "Imperial Ottoman Railway." But he still harped on the complete Railway Route to India. In 1859 he wrote and circulated a pamphlet entitled "Remarks upon

[1] See article "The World's Highway," in the *Calcutta Review*, March, 1856. This is in the Library of the Institution.

the practicability and advantage of Railway Communication in European and Asiatic Turkey";[1] and again in 1878 he prepared and published maps of proposed lines connecting Constantinople with Bagdad and Teheran, obviously part of his route. But there is no record of anything being really done, and although, thanks to Messrs. Siemens, there is an Overland Indo-European Telegraph, the Indo-European Railway is still a thing of the future.

Sir Macdonald's want of success on the difficult ground of the Moslem did not, however, daunt him in his endeavour to extend the blessings of railways among the less advanced peoples of the world; on the contrary, his next attempt was addressed to a great empire still farther removed from western mechanical improvement, namely China. In 1863, when the Taeping rebellion in that country had been put down by the energetic action of the late General C. G. Gordon, Sir Macdonald Stephenson, with unfailing reliance on the civilizing and healing influences of improved communication, visited the home of the Celestials, and interested the mercantile community in his proposal to introduce railways. He obtained much local knowledge from his own observation, and from personal communications with several of the Chinamen, and in 1864, on his return to England, he published a long Report in folio on the whole subject, with a large map showing a comprehensive system of railways which would, in his opinion, most suitably meet the requirements of the country, and also a few short local lines which he considered it advisable to construct at first as pioneers of the more complete system.[2] It was perhaps one of these which, having been laid down at a later time by some enterprising proprietors, was cruelly smashed to pieces by the ungrateful pig-tailed (and pig-headed) populace.

Sir Macdonald's early engineering training was of great service to him for all the work in which he was engaged, and had he followed his own inclination, he would have devoted himself to the practice of the profession; but the time and attention imperatively demanded in the administration of his large undertakings occupied him too much to permit him to combine both callings. It has already been said that he belonged to this Institution for nearly sixty years, and he served it as an "Associate of Council" during the Session 1856–57.

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[1] This pamphlet is in the Library of the Institution.

[2] This Report is in the Library of the Institution.

He was for many years the Governor of "the Copper Mines of England," an old Corporation (holding a Charter from William and Mary, dating 1692) which he extricated from difficulties and restored to prosperity.

He was, in conjunction with Dr. Jeaffreson and Mr. T. H. Hills, one of the originators of the system of ambulances now so common for the removal of patients in infectious diseases.

In speaking of Sir Macdonald Stephenson's great work, something has been said about those traits of character to which his great success may be largely ascribed: a few words may be added here as to the more general estimation in which he was held. The foundation of all was his high sense of religion; he was pronounced to be the ideal of a Christian layman; as free on the one hand from the slightest suspicion of laxity, as on the other hand from any appearance of pharisaical pretension. His ideas of probity were of the most exalted character, and the entire and high confidence placed in his incorruptibility, in positions where, with some men, temptation would have been very powerful, undoubtedly furthered in high quarters the favourable consideration of his proposals. His generosity was great, not merely in pecuniary liberality, but in allowing to every one full, or perhaps sometimes more than full, credit for motives, for ability and for good behaviour. His bright and genial manner, and quickness of humour, contributed largely to make him a favourite in society; and this was augmented by considerable musical ability.

Sir Macdonald lived for the last fifteen or twenty years in retirement, resting after his busy life and enjoying for the most part a calm and healthy old age. But he outlived almost all his fellow-workers and the long span of his life had the disadvantage of blunting in some measure the public recollection of his meritorious career. At last his health failed and his final illness so prostrated him that he kept his bed for some four months and passed away peacefully and without pain, from natural decay, in the eighty-eighth year of his age, on the 20th of November, 1895, at his residence in Tunbridge Wells. He was buried in his family grave at Kensal Green Cemetery.

Sir Macdonald was twice married; first in 1840 to Marianne, daughter of Lieut. Hederstedt, R.N., by whom he had twelve children; and secondly, to Elizabeth, daughter of Captain Bartholomew of H.M. 24th Regiment and widow of Mr. James Tindall, of Scarborough.