

# JOHN HUTCHINSON, THE INVENTOR OF THE SPIROMETER—HIS NORTH COUNTRY BACKGROUND, LIFE IN LONDON, AND SCIENTIFIC ACHIEVEMENTS

by

E. A. SPRIGGS\*

THIS PAPER and the two which follow, by Dr. B. Gandevia and Mr. P. J. Bishop, are concerned with a remarkable man who was born in Newcastle upon Tyne on 14 January 1811. He studied and practised medicine in London, and then emigrated to Australia in 1852, dying in Fiji on 16 July 1861. He was by no means the first to measure human ventilation, and the story of other attempts must be told elsewhere; but his adaptation for this purpose of the gazometer or gasometer of Lavoisier,<sup>1</sup> Watt<sup>2</sup> and Davy,<sup>3</sup> and particularly its exploitation in more than 4,000 clinical measurements, justify his reputation as the inventor of spirometry.

## GENEALOGY

Hutchinson's paternal ancestors can be traced back to the seventeenth century in the parish records of Ryton, still a pleasant village though now partly suburban, a few miles up the Tyne from Newcastle and on the south side. His great-grandfather and grandfather were Parish Clerks.<sup>4,5</sup> They were farmers on a considerable scale as proprietors and tenants, and some plans remain of the family fields.<sup>6</sup> There was no professional man among the paternal relations, but our subject's uncle (also called John, 1779–1808) attended medical classes at Edinburgh in the session 1799–1800; he did not graduate, but he read a paper to the Natural History Society of Edinburgh on 30 May 1799 'On detonation', which may still be seen in the Edinburgh University MSS.

The maternal forebears of our subject were gentlefolk,<sup>7</sup> the Collinsons of Aydon

\*E. A. Spriggs, D.M., F.R.C.P., is Chest Physician to the General Hospital, Newcastle upon Tyne NE4 6BE.

<sup>1</sup> Antoine-Laurent Lavoisier, trans. Robert Kerr, *Elements of chemistry*, Edinburgh, William Creech, 1790, pp. 308–319.

<sup>2</sup> Thomas Beddoes and James Watt, *Considerations on the medicinal use of factitious airs*, Bristol, J. Johnson & H. Murray, 1794, part II, pp. 1–10.

<sup>3</sup> Humphry Davy, *Researches*, London, J. Johnson, 1800, pp. 573–576.

<sup>4</sup> Richard Welford, 'Local Muniments', *Archaeologia Aeliana*, Newcastle upon Tyne, Andrew Reid, 1909, 3rd series, 5: 114.

<sup>5</sup> *The general election roll for knights of the shire; to represent in parliament the County Palatine of Durham*, Newcastle upon Tyne, D. Akenhead, 1790, p. 11.

<sup>6</sup> University of Durham, Department of Palaeography and Diplomatic, South Road, Gibson Deposit, plan no. 146.

<sup>7</sup> John Crawford Hodgson, *A history of Northumberland*, Newcastle upon Tyne, Andrew Reid, 1902, vol. 6, pp. 135–137.

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Castle, north of the Tyne, and indeed there is a tradition in the family, hard to substantiate, of descent from the great Earl of Clarendon. He was, of course, father of Anne Hyde, who married James Duke of York and bore him Queen Mary II and Queen Anne, but died before James became king.

LIFE IN THE NORTH EAST

The parents, James and Anna Hutchinson, were living in Percy Street, Newcastle, when they took John to be baptised on his first birthday.<sup>8</sup> James was a “coal fitter” or coal merchant<sup>9</sup> as well as a lessee of collieries.<sup>10,11</sup> He appears to have had his coal office in the yard behind the Custom House on Quayside.<sup>12</sup> He had also a partnership in a brewery at Stella<sup>13</sup> and owned a public house, the Lambs Arms, at Crawcrook<sup>14</sup>—both of these villages were in Ryton parish.

From Percy Street, James and his family may have moved to Sheriff Hill,<sup>15</sup> south of Newcastle in a colliery area where he had an interest, and then not later than 1820 he bought from J. H. Wharton Esq., M.P., an estate at Hookergate<sup>16</sup> in the south-west part of Ryton parish, and built a house there<sup>17</sup> some time before his death in 1832 (the tombstone is shown in plate II). A valuation of this estate, comprising 142 acres, about the time of his death is still available<sup>18</sup> and the plan which probably goes with it. The Mansion House is valued at £216, and the lands at £3,092; John Hutchinson, being the only child, may be presumed to have inherited. The estate was then sold, however,<sup>19</sup> and the house was replaced by another building, called Beda Lodge, in the 1850s.<sup>20</sup> There were, when the Hutchinsons lived at Hookergate, a farm, granary, stables, and “fold yard”. The farming stock was also advertised when James Hutchinson died.<sup>21</sup>

It is not known where John Hutchinson went to school. There is no record of him at the Newcastle Royal Grammar School, Durham School, or Sedbergh. A recent Rector of Ryton suggests the Bruce Academy in Percy Street, where George Stephenson sent his son Robert, who was to become, like his father, a distinguished railway and mining engineer. Robert was eight years senior to John Hutchinson, and later

<sup>8</sup> St. Andrew's Church, Newgate St., Newcastle upon Tyne, Baptismal Register, 14 January 1812.

<sup>9</sup> *A general directory for Newcastle upon Tyne, Gateshead, and places adjacent*, Newcastle, printed by Francis Humble, Durham, for the publisher, 1824, p. 70.

<sup>10</sup> Gateshead, Tyne and Wear, Public Libraries, Cotesworth MSS., CA/2/158 and CA/2/160.

<sup>11</sup> North of England Institute of Mining and Mechanical Engineers, Neville Hall, Newcastle upon Tyne NE1 1TD. Letter from James Hutchinson to John Watson, Watson Collection, vol. 96.

<sup>12</sup> William Parson and William White, *History directory and gazetteer of the counties of Durham and Northumberland*, Newcastle, 1827, pp. 46 and 106.

<sup>13</sup> *Newcastle Courant*, 19 May 1821, p. 1.

<sup>14</sup> *Newcastle Journal*, 1 September 1832, p. 2.

<sup>15</sup> Parson and White, *op. cit.*, note 12 above.

<sup>16</sup> Robert Surtees, *The history of antiquities of the County Palatine of Durham*, Sunderland, Hills, 1909, p. 174.

<sup>17</sup> E. Mackenzie and M. Ross, *An historical, topographical, and descriptive view of the County Palatine of Durham*, Newcastle upon Tyne, Mackenzie & Dent, 1834, vol. 1, p. 205.

<sup>18</sup> University of Durham, Department of Palaeography and Diplomatic, South Road, Gibson Deposit, Paper No. 122 and Plan No. 68.

<sup>19</sup> *Newcastle Journal*, 22 September 1832, p. 1.

<sup>20</sup> Personal communication from G. Houlden Esq., who recently owned Beda Lodge.

<sup>21</sup> *Newcastle Journal*, 1 September 1832.



Plate I.

Portrait of John Hutchinson in the possession of Major John Jowett, a great-great-grandson. On the back are the name, dates, and some inaccurate particulars; also the coat of arms (which is also visible at the top of the memorial stone in Plate II), and the motto "*Fortiter gerit crucem*".



Plate II.

There are two memorial stones in Ryton Church relating to John Hutchinson and his ancestors. That shown commemorates John Hutchinson himself, and his father and mother; "the Heath" probably refers to Hampstead. Another stone nearby commemorates on the front and back several other relations.

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said about his teacher, John Bruce, "It was from him that I derived my taste for mathematical pursuits and the facility I possess of applying this kind of knowledge to practical purposes."<sup>22</sup> No list of pupils for the relevant time has been found.

The only fragments of knowledge we have about Hutchinson's early years are that his boyhood's favourite was (James) Cook; that his mind was early directed to mechanical engineering, of which he made ingenious constructions at an early age, and that he was in the habit of descending the coalmines on the Tyne.<sup>23</sup> He himself said that he had been not less than 200 or 300 times in the mines.<sup>24</sup>

That he returned regularly to the North East is suggested by his evidence to the House of Lords<sup>25</sup> on mining disasters. One wonders whether, when he went to Jarrow Colliery on 23 December 1845, he was up visiting his old haunts for Christmas. He is also said to have lectured to the Literary and Philosophical Society of Newcastle,<sup>26</sup> but that society has now no record of this.

LONDON

No connexion has been found with the Newcastle College of Medicine, but Hutchinson attended University College, London,<sup>27</sup> where he was probably taught by Sir Charles Bell, the celebrated anatomist, and by Dr. Dionysius Lardner, Professor in Natural Philosophy and Astronomy. Mr. W. R. Merrington, F.R.C.S., tells me that on 2 October 1834 Hutchinson paid £3 for a course of Medical Jurisprudence by Dr. A. T. Thomson; in January 1834 £3 for *Materia Medica* by Dr. A. T. Thomson; in January 1835 £3 for *Practice of Medicine* by Dr. Elliotson; and in February 1835 £4 for *Chemistry*. He took the M.R.C.S. in 1836<sup>28</sup> and became one of the Physicians to the Britannia Life Assurance Company,<sup>29</sup> and Surgeon to the Southampton Dispensary, Leigh-street, Burton-crescent,<sup>30</sup> not far from University College. He had given up this latter appointment by 1845.

In 1842 Hutchinson became a Fellow of the Statistical Society,<sup>31</sup> newly founded by Farr, and in 1848 he obtained the degree of M.D. Giessen on thesis and in absentia.<sup>32</sup> Then the London directories begin to change Mr. Hutchinson, surgeon, to Dr. Hutchinson, physician. And in 1850, for a brief two years, he became Assistant Physician to the Hospital for Consumption, Brompton.<sup>33</sup>

Hutchinson was married from 30 Gower Place on 23 April 1840, in St. Olave's Church, Hart Street, City of London, to Ann Sarah, daughter of Henry Buckle,

<sup>22</sup> John Bruce Williamson, *Memorials of John Bruce and Mary Bruce*, Newcastle upon Tyne, Andrew Reid, 1903, p. 241.

<sup>23</sup> See P. J. Bishop, 'A bibliography of John Hutchinson', pp. 384–396 of this issue [hereinafter cited as Bishop], No. 33.

<sup>24</sup> Bishop No. 19.

<sup>25</sup> *Ibid.*,

<sup>26</sup> Bishop No. 33.

<sup>27</sup> Bishop No. 36.

<sup>28</sup> Records of the Royal College of Surgeons of England, 29 April 1836.

<sup>29</sup> Bishop No. 33.

<sup>30</sup> *The London Medical Directory*, London, C. Mitchell, 1845, pp. 84–85.

<sup>31</sup> Bishop No. 36.

<sup>32</sup> Personal communication from W. Leist, Justus Liebig-Universität, Giessen.

<sup>33</sup> See description in Bishop No. 36.

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described as a merchant.<sup>34</sup> From 1845 to the time of his emigration he occupied a house at 105 Milton Street, now Balcombe Street, near Marylebone Station.<sup>35,36</sup> The house was built in 1844, but it is not possible to be sure from the rating records whether Hutchinson owned it or rented it from the Portman Estate. It has been replaced by modern buildings, but much of the street still preserves an early nineteenth-century air of some distinction.

They had three children, and I have been fortunate to meet a great-grandson, Field Marshal Sir Geoffrey Baker, G.C.B., C.M.G., C.B.E., M.C., recently Chief of the General Staff, and his daughter Alexandra, now Mrs. Thomas Bremridge.

CONTRIBUTIONS TO MEDICAL SCIENCE

Hutchinson's water spirometer was much the same as the instrument we use today. It did not make a graphic record, and had the disadvantage that the patient or the observer had to turn off the stopcock at the end of expiration, to confine the air until the position of the index was read on the graduated scale. Volumes were measured at manometrically adjusted atmospheric pressure, and corrected by calculation for any deviation of room temperature above or below 60°F. Hutchinson defines the vital capacity as "the number of cubic inches given by a full expiration following the deepest inspiration".<sup>37</sup> He divides the quantity of air in the thorax into:

*Hutchinson's term*  
complemental air  
breathing air  
reserve air  
residual air

*Corresponding modern term*  
inspiratory reserve volume  
tidal air  
expiratory reserve volume  
residual volume

It is appropriate that one of Hutchinson's first presentations was to the Statistical Society.<sup>38</sup> He shows that there is a linear relationship of vital capacity with height, and draws frequency distribution curves.<sup>39</sup> He finds no relationship to weight, if correction is made for height—except that above a certain weight, for any given height, the vital capacity diminishes. The relationship between chest circumference and vital capacity is found to be irregular, if anything inverse. The vital capacity diminishes with age. "I have found a dinner diminish the vital capacity to the extent of 12 and even 20 cubic inches."

Both the content and the presentation of Hutchinson's papers seem to have been admired. At the Royal Medical and Chirurgical Society<sup>40</sup> "A Fellow of the Society having complied with the request to come forward and submit himself to experiment, his height was found to be five feet five inches, and, accordingly, the quantity of

<sup>34</sup> General Register Office, Somerset House, London, certified copy of an entry of marriage, application number 8535D.

<sup>35</sup> Bishop No. 17(j), p. 117.

<sup>36</sup> Archives Department, Westminster City Libraries, Marylebone Road, London NW1 5PS, Rating Records.

<sup>37</sup> Bishop No. 7.

<sup>38</sup> Bishop No. 3.

<sup>39</sup> Bishop No. 7.

<sup>40</sup> Bishop No. 9.

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air he could expel should, by the tables, be 206 cubic inches (3,380 ml.). The gentleman then breathed into the spirometer, and actually produced 205 cubic inches, which, making allowance for temperature, make it 206 cubic inches. This was so satisfactory, as to leave no doubt on the mind that these tables must have been calculated with care, and upon an extensive number of cases.”

When Hutchinson took the circumference of the chest he usually deducted 1/4in. for the shirt and another 1/4 in. for the flannel. Though he made measurements with the spirometer on women, he wrote “We do not know the vital capacity of women, nor is it easy to determine it, because of their tight dress,”<sup>41</sup> though further on he comments “We never heard a woman acknowledge that she wore her clothes tight”.

Hutchinson considered the spirometer useful in the diagnosis of disease, but he had in mind not so much, as we should today, conditions with airways obstruction such as asthma, emphysema, and chronic bronchitis. There were no cigarettes then, but he did observe the inspiratory sinking and expiratory bulging of the intercostal spaces and base of the neck in emphysema, commenting “there must be some impediment in the air tubes”.<sup>42</sup> Rather, in spirometric measurements, was he concerned with the great killer of his time, phthisis, which diminishes vital capacity by destroying the lung tissue. In 1842 Freeman, the American giant, under whose skeleton one may still stand at the Royal College of Surgeons, came to England, and Hutchinson examined him before a prize fight.<sup>43</sup> He was 6 ft. 11¼ ins. high, and weighed 19 st. 5 lb. He had the very large vital capacity of 434 cu. in., 88 per cent of what one would now predict from his height and weight. Freeman spent a rambling and dissolute life for the next two years and then, when he became ill, weighed two stone less, and had a vital capacity of 344. He was taken to two “physicians well skilled in auscultation”, who could not detect organic disease. He died the next year, and autopsy showed phthisis.

All but the youngest physicians today will remember temperature charts where the nurses had twice daily, at the bottom, recorded respiratory rates “20–20–20 . . .”. I was always puzzled by this figure, evidently taught in the nursing schools as one from which it was hazardous to deviate; for it is far too high for a resting healthy person who is not anxious. Hutchinson may be responsible.<sup>44</sup> He counted the respirations in 1,714 cases, in the sitting posture, and found both the median and average rates to come out at twenty per minute, though the range was from six to forty. The pulse rates were also high, at eighty, and it is probable that most of the experimental subjects were in a state of apprehension. It is curious that John Dalton (1813)<sup>45</sup> had found that in a state of quiescence he himself took twenty inspirations a minute. Hutchinson does note<sup>46</sup> that a man after a narcotic breathed twice in a minute.

He measured positive and negative pressures which could be produced by activity in the chest.<sup>47</sup> He also obtained, in two corpses, measurements relating pressure with volume.<sup>48</sup>

<sup>41</sup> Bishop No. 26.

<sup>42</sup> Bishop No. 25.

<sup>43</sup> Bishop No. 7.

<sup>44</sup> *Ibid.*

<sup>45</sup> John Dalton, ‘On respiration and animal heat’, *Mem. Proc. Manchr. Lit. Phil. Soc.*, Ser 2, 2: 26.

<sup>46</sup> Bishop No. 26.

<sup>47</sup> Bishop No. 7. <sup>48</sup> Bishop No. 25.

It is hard to believe that one of the great physiological controversies of the eighteenth century had been that between von Haller and Hamberger, who differed as to the function of the interosseous portion of the internal intercostal muscles. They agreed that the external intercostals and the intercartilaginous internal intercostals were inspiratory, but von Haller thought the interosseous internal intercostals were inspiratory, whereas Hamberger thought them expiratory. Hamberger (1749)<sup>49</sup> had a volume published in which Haller's *De respiratione* was interspersed with Hamberger's critical comments. On this controversy, Hutchinson quotes Haller: "Let it be allowed me to deplore, among the miseries of human life, that such anger and bitter quarrels should be forced upon us on account of matters wherein we are so little personally concerned". Hutchinson, on anatomical and mechanical grounds, took Hamberger's view, and has lately<sup>50</sup> been proved correct by electromyographic studies.

Hutchinson published figures on the familial disposition to phthisis.<sup>51</sup> He distinguished, on rather doubtful grounds, between the "crackles" of consumption and what he calls the "crepitations" of bronchitis and pneumonia.<sup>52</sup> He comments: "If Laennec had done no more in his short space of time, than discover this crepitating sound, and the pathology thereof, Laennec had erected for himself a monument, more durable than any now standing, on the plains of Egypt".

It is likely that much of Hutchinson's earnings in London came from insurance work. His last known publication *The spirometer, the stethoscope and scale-balance* is directed particularly to this aspect.<sup>53</sup> He regarded a family history of consumption, apoplexy or insanity as prejudicial to long life, and he held particularly strong views on alcohol.

#### EVIDENCE BEFORE SELECT COMMITTEE OF HOUSE OF LORDS

The minutes of Hutchinson's evidence on accidents in coal mines<sup>54</sup> deserve comment, because they bring the man to life—also because they reveal the shocking conditions in which miners worked, and not infrequently died.

Hutchinson pointed out to their lordships that, among deaths following explosions, the major part of the mortality was from suffocation: ". . . Haswell exploded in April 1845; there were 14 burnt and 81 were suffocated." "I have seen men frequently brought out of a mine (it was so in the case of Springwell, which happened 9th May 1833), close from beside the bottom of the shaft, with a perfectly placid and calm expression, without the slightest mark upon their persons of fire or violence . . .".

It may be explained that, even within the memory of people still living, ventilation in these coal mines was achieved by underground furnaces causing air to rise. Hutchin-

<sup>49</sup> Georg Erhard Hamberger, *De respirationis mechanismo et usu genuino*, Jena, J. C. Crocker, 1749.

<sup>50</sup> A. Taylor, "The contribution of the intercostal muscles to the effort of respiration in man", *J. Physiol. (Lond.)*, 1960, 151: 390–402.

<sup>51</sup> Bishop No. 26.

<sup>52</sup> Bishop No. 20(c).

<sup>53</sup> Bishop No. 26.

<sup>54</sup> Bishop No. 19.



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son described the complicated arrangements which had to be perfected to make a continuous current of air. Often a partition, or brattice, of wood was all that separated two air streams in contrary directions, and an explosion causing a hole in the brattice could condemn to suffocation numbers of men far beyond. This he illustrated to the Select Committee: "The Witness exhibits an experiment with a candle, over which he places a glass tube 20 inches long, and the candle almost immediately goes out; but on again lighting it, and introducing a division, representing a brattice, down the centre of the tube, the candle continues to burn clearly." Having, one feels sure, impressed the committee by this demonstration, Hutchinson pointed out the engineering methods by which flimsy brattices could be avoided.

According to Hutchinson's evidence, Jarrow colliery exploded seven times in twenty-nine years: "When I was going to that mine, I asked a miner 'Which is the way to Jarrow colliery?' and he said 'Sir, I do not know of any colliery; but there (pointing me in the direction of the colliery) is a butcher's shop;' and that was a man who did not know I was making any inquiries into the state of the mine . . .".

But the Select Committee was to enjoy a second dramatic demonstration, that of Hutchinson's method of lengthening the time a rescuer can go without breathing poisonous gas: "If any of your Lordships will look at your watch, as soon as I am ready I will strike the table . . . (The Witness makes several deep inspirations and expirations, then held his breath for the space of a minute and a half)".

**MIGRATION TO AUSTRALIA**

Hutchinson left England in September 1852.<sup>55</sup> Why did he go? There is the hint of an explanation in the *Lancet* annotation of 1920, which refers to Professor G. Dreyer's "recent" dedication to Hutchinson of a book on the assessment of physical fitness.<sup>56</sup> This annotation says that "soon after the discovery in 1851 of gold deposits in Australia he [Hutchinson] left England". Certainly Hutchinson was interested in mining, but this is hardly likely to be the whole story.

Another possible explanation is that Hutchinson developed consumption, for the journey to Australia was a recognized way of "taking the cure" in those days.<sup>57</sup> There is no evidence that he was sick. Alcoholism is possible, and would fit in with some of the Australian escapades and with the rumours from Fiji about his end (see B. Gandevia, 'Dr. John Hutchinson in Australia and Fiji', pp. 365–383). Is it in favour of this hypothesis or against it that, writing of insurance examinations, Hutchinson inveighs against the drunkard? "Domestic distress and grief may drive him foolishly to seek rest of mind, by intoxication. . . . Sobriety is an ornament; if this ornament is not in the applicant we should *decline the case*".<sup>58</sup>

Another speculative suggestion (and of course more than one of these reasons may have been operative) is that Hutchinson's marriage was not happy. Dr. Gandevia will deal with the interesting point that Hutchinson's will did not mention his wife or children (see pp. 377–379). Mrs. Bremridge, a descendant, tells me that the children

<sup>55</sup> Bishop No. 33.

<sup>56</sup> Georges Dreyer, *The assessment of physical fitness*, London, Cassell, 1920.

<sup>57</sup> K. Bryn Thomas and Bryan Gandevia, 'Dr. Francis Workman, emigrant, and the history of taking the cure for consumption in the Australian colonies', *Med. J. Aust.*, 1959, 2: 1–10.

<sup>58</sup> Bishop No. 26.

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succeeded to trust funds bringing in £500 p.a. each, but it is not clear whether these came from their father or their mother.

#### THE MAN

From Hutchinson's achievements and writings, one pictures a precise, forceful and industrious personality. There is Australian evidence, (see Gandevia pp. 371–373), that he was aggressive in his later years. The *Medical Times* obituary<sup>59</sup> notes that he had an exquisite ear for music, his execution on the violin being masterly; that he had great ability as a draughtsman; that he sculptured admirably in basso relievo; and that he painted in oils. Some of his writings are illustrated by the most delightful silhouettes and one wonders whether he drew these himself. At the Royal Medical and Chirurgical Society he was asked whether he had examined any men of remarkably small stature. He replied that he had in the course of his observations, sought out the giant and the dwarf: "He then handed a spirited sketch of a human being, whose height was under thirty inches—Don Francisco, aged 42". One imagines that Hutchinson had made the sketch himself. The obituary also states that he conducted researches on vital statistics and meteorology and was noted for his dramatic and conversational powers.

It seems, in retrospect, a great loss to British medicine that Hutchinson should have emigrated, for reasons which are not clear, and ceased scientific work at the age of forty-one.

#### SUMMARY

John Hutchinson (1811–1861) came from Newcastle upon Tyne and received his medical education at University College London. He practised especially in insurance work, and wrote about this, as well as about his celebrated spirometer, the functions of the intercostal muscles, ventilation in coal mines, and other subjects relating to respiration. He became Assistant Physician at the Brompton Hospital.

At the age of forty-one he left his wife and children, abandoned his professional position and scientific work, and migrated to Australia. We do not know why he did this, but his later career is taken up by Dr. B. Gandevia in the paper which follows.

#### ACKNOWLEDGEMENTS

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<sup>59</sup> Bishop No. 33.