

# The Agricultural Research Association, the Development Fund, and the Origins of the Rowett Research Institute

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## Abstract

The Aberdeen Agricultural Association, later renamed the Agricultural Research Association, was established in 1875. Relying upon donations from landowners, the Association set up an experimental station and laboratory, and for a few years ran an experimental farm. From the beginning, the organization challenged the views of agricultural scientists in England. Thomas Jamieson, the Association's chemist, demonstrated that insoluble phosphate was a more useful fertiliser than had been supposed, and later claimed to have shown that green plants could fix atmospheric nitrogen. This led to a bruising conflict with the director of Rothamsted Experimental Station. In the 1910s the Association's work ceased after it failed to secure a grant from the newly-formed Development Commission. In contrast, a joint committee of the North of Scotland College of Agriculture and Aberdeen University obtained Development Commission funds for an animal nutrition laboratory, and in 1914 appointed John Boyd Orr, a Glasgow medical graduate, as research worker. Orr proved much more effective than Jamieson, both in building and using alliances with members of the agricultural science establishment in England, and in obtaining private funds, leading to the official opening of the Rowett Research Institute, of which Orr was designated director, in 1922.

THE Development Fund, established under the Development and Road Improvement Act, 1909, is one of the measures associated with David Lloyd George's 'People's Budget'. The act sought to encourage economic development by various means, including the support of agricultural education and research, and may be regarded as part of the Edwardian movement to promote 'public science' and enhance 'national efficiency'.<sup>1</sup> The fund was disbursed by the Treasury on the recommendations of eight commissioners and during 1910 two applications for grants were received from Aberdeen: one, from the Agricultural Research Association (ARA), was unsuccessful, contributing to the final demise of this organization; the other, from the Aberdeen and North of

Scotland College of Agriculture, led to the commencement of a modest programme of research before the war, and to the formation of the Rowett Research Institute in the early inter-war period. Directed by John Boyd Orr, by the 1930s the Rowett had become world-famous for research in both animal and human nutrition.

We will see that the final stages of the existence of the ARA were characterized by acrimonious controversy between the agricultural research establishment and the ARA's idiosyncratic director, Thomas Jamieson, over the latter's claims to have shown that green plants can fix atmospheric nitrogen. Nevertheless, the continuous activity of the ARA and its predecessor organization over the period 1875-1913 was, in itself, something of an achievement in Scotland. Russell's *History of Agricultural Science* gives the impression that, while England saw the development of research at Wye College, Cambridge University,

<sup>1</sup> B K Murray, *The People's Budget 1909/10: Lloyd George and Liberal Politics*, 1980; R Olby, 'Social imperialism and state support for agricultural research in Edwardian Britain', *Annals of Science*, 48, 1991, pp 509-26; F M Turner, 'Public science in Britain, 1880-1918', *ISIS*, 71, 1980, pp 589-608; G R Searle, *The Quest for National Efficiency: A Study of British Politics and Political Thought, 1899-1914*, 1971.

Long Ashton, Cockle Park and elsewhere during this period, the main role of Scotland was to produce researchers rather than research. Scotsmen, such as William Somerville, T H Middleton, D A Gilchrist and F H A Marshall, pursued their careers at the new institutions south of the border. In Scotland, even the Highland and Agricultural Society failed to sustain the experimental stations run by its chemist beyond the period 1877-89.<sup>2</sup> Paul Brassely regards 1890 as a turning point in the fortunes of agricultural research in Britain prior to the First World War, yet not one of the institutional developments that he mentions took place in Scotland.<sup>3</sup>

This paper is not intended to be a scientific assessment of the research done by the Agricultural Research Association and the Rowett Research Institute. It rather forms a local case study of the transformation in the organization of agricultural science during the early twentieth century, which accompanied the advent of large-scale public funding. The story brings into focus the challenges faced by those in Scotland who sought to extract a share of centrally-administered research funds, as well as the special circumstances which influenced developments in Aberdeen.

## I

The initial aim of the Aberdeen Agricultural Association, established in August 1875, was to conduct experiments 'principally for the purpose of guiding and informing Farmers in regard to the application of Manures'.<sup>4</sup> The 'Acting Committee' of twelve consisted of land-

owners, farmers and factors, two manufacturers of manures and a seedsman, with the Marquis of Huntly as president. The formation of the Association was largely the initiative of James W Barclay, MP for Forfarshire since 1872.<sup>5</sup> Barclay was initially a Liberal and later a Unionist. Local self-made chemist Thomas Jamieson, lecturer in chemistry at the Mechanics Institution in Aberdeen, was employed to direct the Association's experiments. In about 1878 Jamieson became city analyst for Aberdeen<sup>6</sup> and from 1879 vigorously applied himself to the development of agricultural education at Aberdeen University as Fordyce Lecturer in agricultural science.<sup>7</sup>

The income of the Association was £350-£380 per annum, provided mostly by landowners. In 1880, for example, £360 was raised from 40 subscribers, but seven of them, including the inhabitants of Aboyne Castle, Cluny Castle, Gordon Castle, and Haddo House gave a total of £250. One large donation was given by W Cunliffe Brooks, Conservative MP for Cheshire East, who owned property in Aboyne. About one-fifth of the remaining subscribers were manure manufacturers and other agricultural suppliers.<sup>8</sup>

Four field stations were established on land belonging to the Association's supporters, for research on the use of phosphates for growing turnips. Such a project was ideally suited to the needs of the farmers of the North-East, which had, by this time, become famous for its fat cattle, and in order to produce sufficient winter feed, much effort was put into achieving good turnip crops. And according to I A Symon the dissemination of results of experiments such as these helped farmers

<sup>2</sup> E J Russell, *A History of Agricultural Science in Great Britain*, 1966, pp 183-252; J D G Davidson, *The Royal Highland and Agricultural Society of Scotland. A Short History 1784-1984*, Ingleston, 1984, pp 23-4.

<sup>3</sup> P Brassely, 'Agricultural research in Britain, 1850-1914: failure, success and development', *Annals of Science*, 52, 1995, pp 465-80.

<sup>4</sup> 'Extract from minute of the first meeting of the subscribers, August 1875', in *Proceedings of the Aberdeen Agricultural Association 1875-82*, Library of the School of Agriculture, Aberdeen [hereafter LSAA], xPer 630Abe [hereafter *Proceedings 1875-82*].

<sup>5</sup> 'Obituary', *The Times*, 2 March 1907, p 8e; 'In memorium' in T Jamieson, *Utilisation of Nitrogen in Air by Plants III*, Aberdeen, 1907-8 (*Aberdeen Research Association Report*, 1907-8), pp 3-5.

<sup>6</sup> According to Mr Thomas Jamieson, *Chev Fr, FIC, Sketch of his Life and Work*, Aberdeen, 1899, by 1899 Jamieson had held the post of public analyst for 21 years.

<sup>7</sup> J Hendrick, *The Progress of Agricultural Education in Scotland*, Aberdeen, 1912.

<sup>8</sup> 'List of subscribers for the fifth season', 1880, in *Proceedings 1875-82*.

in Scotland to reduce fertiliser costs during the economic difficulties of the late nineteenth century.<sup>9</sup>

At each of the field stations, 36 plots were laid out, each sufficient for 200 turnips,<sup>10</sup> and Jamieson soon concluded, from experiments with the mineral coprolite, finely ground, that 'soluble phosphate is not superior to insoluble phosphate to the extent that is supposed'.<sup>11</sup> It was claimed that farmers had been wasting money using 'superphosphate', manufactured by treating insoluble phosphates with sulphuric acid.<sup>12</sup> The method for the production of superphosphate had been patented in 1842 by J B Lawes, FRS, the owner and founder of Rothamsted Experimental Station. Lawes's wealth, and Rothamsted, owed much to the view that insoluble phosphates were unavailable to plants.

In 1880, Jamieson's claims were challenged by J C A Voelcker, FRS, consulting chemist to the Royal Agricultural Society. Contrary to previous statements Voelcker now accepted that insoluble phosphates had 'fertilising properties', but suggested 'treatment with acid is the most economical and best plan of utilising mineral phosphates'. Jamieson replied to Voelcker in *The Mark Lane Express*, resulting in an exchange with Bernard Dyer, Voelcker's former assistant. Dyer criticized the small scale of the Aberdeen experiments and pointed out the variability in Jamieson's results. But while Dyer thought Jamieson's experiments could not give 'definite or precise information' he also stated: 'That ground coprolites may increase the turnip crop, there is no doubt in my mind ...'. Jamieson included these articles, and his replies, and an exchange with Lawes in *North British Agriculturalist*, in his report to the Association for 1880, and concluded, 'the "battle of the phosphates" is

now nearly over'.<sup>13</sup> In his report for the following year Jamieson triumphantly proclaimed victory and noted that the view that fossil phosphates should be regarded as assimilable by plants had been endorsed by an 'International Congress of Directors of Agricultural Experimental Stations' held in Paris.<sup>14</sup>

Ground insoluble phosphates were certainly more valuable as fertilisers than many other scientists had supposed before Jamieson's work but Russell explained Jamieson's success with ground coprolites as resulting from their application to acidic soils, in which conditions insoluble phosphates are more readily available to crops.<sup>15</sup> That insoluble phosphates are only useful in acidic soils is now the standard textbook view,<sup>16</sup> but some degree of uncertainty remains: one recent author who made a special study of insoluble phosphates argued that it is the concentration of calcium ions in the soil rather than acidity which is most important.<sup>17</sup>

## II

After the first two seasons, Jamieson began to study other problems, such as the valuation of manures, the use of manures in the production of hay, grain and straw, and the cause of 'finger-and-toe disease' in turnips.<sup>18</sup> Jamieson's initial approach to 'finger and toe disease' was to question 200 farmers about their experiences of the problem and, following trails, he later concluded that the disease was associated with the use of superphosphate.<sup>19</sup> Jamieson regarded this as one of the most important findings of the Association and later

<sup>9</sup> I A Symon, *Scottish Farming Past and Present*, 1959, pp 196, 205.

<sup>10</sup> T Jamieson, 'Report', March 1877, in *Proceedings 1875-82*, p 6.

<sup>11</sup> T Jamieson, 'Report', 1877, in *ibid*, p 32.

<sup>12</sup> T Jamieson, 'Report', March 1879, in *ibid*, p 10.

<sup>13</sup> T Jamieson, 'Report', Season 1880, in *ibid*, pp 36-40, 44-8, 50.

<sup>14</sup> T Jamieson, 'Report', Season 1881, in *ibid*, pp 5-6.

<sup>15</sup> Russell, *Agricultural Science*, pp 185-6.

<sup>16</sup> George W Cooke, *Fertilizing for Maximum Yield*, 1982, p 145.

<sup>17</sup> G R Davies, *Comparison of Insoluble Phosphate Fertilisers*, Welsh Soils Discussion Group: Special Report No 1, 1984, p 67.

<sup>18</sup> T Jamieson, 'Report', March 1879, and 'Report', March 1882, in *Proceedings 1875-82*, pp 17-19, 11-16.

<sup>19</sup> T Jamieson, 'Report to the Committee', March 1879, and 'Report to the Committee', March 1882, in *ibid*, pp 17-19, 11-16.

remarked that this was 'one of the few findings of the Association that have been accepted without opposition'.<sup>20</sup> This is probably because Jamieson's views were in line with established knowledge and practice: he accepted the recent findings of the Russian scientist M Woronin that a fungus was the immediate cause of finger-and-toe, and liming had long been used to control the problem.<sup>21</sup> It was a small step to the conclusion that superphosphate, which was regarded as an acidic manure, aggravated the problem. Even Jamieson's rival, A D Hall, expressed this position.<sup>22</sup> Later writers, however, while accepting the association between finger-and-toe and acidity, no longer regard superphosphate as increasing soil acidity.<sup>23</sup>

Jamieson's report for 1881 advocated establishing an experimental station and farm, and in order to pursue this objective the Aberdeen Agricultural Association was transformed, in 1883, into the Agricultural Research Association (ARA), which, it was hoped, would be able to sustain the more ambitious programme more effectively.<sup>24</sup> A group of about fifteen, of similar social composition to those giving the largest sums to the original organization, provided donations of £50-500, and an additional 41 people provided subscriptions of up to £25.<sup>25</sup> Land was leased at Glasterberry, near Peterculter, close to Aberdeen, and used for a research station, laboratory, and an experimental arable farm.

Twelve lines of ten one-thousandth of an acre plots were laid out. Just as Jamieson had been criticized for using small plots for

the original field experiments, he was now criticized for using even smaller experimental plots. He explained that such plots allowed for strict control of every condition such as drainage, subsoil, soil and cultivation, but this never satisfied the critics however.<sup>26</sup> Further experiments directed by Jamieson were carried out in England under the auspices Sussex Association for the Improvement of Agriculture, an organization which was formed at Jamieson's suggestion along the lines of the ARA, after he was contacted by a landowner from the county. The work in Sussex was directed by Jamieson for twelve years, until he gave it up because of health problems in the early 1890s.<sup>27</sup>

The ARA's farm was only worked for five years and was given up by 1889, after which investigations were confined to the research station and laboratory with some larger-scale trials on the farms of supporters. The failure of the farm was ascribed mainly to bad seasons and a sharp fall in prices. Nevertheless, based on his five-year's experience, Jamieson was soon boldly stating that the results of 'disregarding rotation and of severe cropping ... so long as there is suitable and sufficient manure given, need not be feared'.<sup>28</sup> The farm had also involved a social experiment. Farm servants often lodged with farmers but in Jamieson's view, 'Such close communication ... leads to insubordination ... and to peculiar notions of work and duties'.<sup>29</sup> He therefore converted a byre to provide rooms for four men and a housekeeper. And instead of being bound to work for six months, Jamieson's farm servants were engaged by the week.

<sup>20</sup> T Jamieson, *History of the Progress of Agricultural Science in Great Britain*, Edinburgh, 1911, pp 83-4.

<sup>21</sup> R N Campbell and A S Greathead, 'Control of clubroot of crucifers by liming', in A W Englehard, ed, *Soilborne Plant Pathogens: Management of Diseases with Macro- and Microelements*, Minnesota, 1989, pp 90-101.

<sup>22</sup> A Daniel Hall, *Fertilisers and Manures*, 1912, p 151.

<sup>23</sup> A Beaumont, *Diseases of Farm Crops*, 1959, p 85; K Parsley, *Fertilisers and Manures* 1959, p 71.

<sup>24</sup> T Jamieson, 'Report', March 1882, in *Proceedings 1875-82*, p 33.

<sup>25</sup> T Jamieson, 'Circular', No 7, January 1888, in *Proceedings Agricultural Research Association 1885-90*, LSAA, xPer 630Agr [hereafter *Proceedings 1885-90*], pp 16-17.

<sup>26</sup> 'Organisation, object and work of the Aberdeenshire Agricultural Research Association', in *Proceedings of the Agricultural Research Association 1891-99*, LSAA, xPer 630Agr [hereafter *Proceedings 1891-99*], p vi.

<sup>27</sup> *Annual Reports of the Proceedings of the Sussex Association for the Improvement of Agriculture, 1881-89*, LSAA, xPer 630Sus.

<sup>28</sup> T Jamieson, 'Report' Season 1890, in *Proceedings 1885-90*, p 9.

<sup>29</sup> *Ibid*, p 4.

Despite the initial generosity of land-owners, the ARA was continuously short of funds, but from the late 1880s a share was received of the first sums made available by the government for agricultural research. In 1888 the Agricultural Department of the Privy Council gave the ARA £150.<sup>30</sup> Jamieson commented that the value of the grant lay not in the amount but in the recognition of the work of the ARA. In his view 'the slow and delicate separation of facts from mistaken ideas with which the untrained familiarity of generation has surrounded almost every Agricultural subject' implied the need for

... conditions attainable only by peaceful continuity, as well as a position independent of popularity, of incompetent criticism, and of personal or class interests. Perhaps only the State, looking to the subject from a national point of view, can provide such conditions.<sup>31</sup>

Jamieson was, however, to be bitterly disappointed. The Board of Agriculture, established in 1889, took over the Privy Council grant but reduced it to £100 from 1893-4, and withdrew it altogether in 1907. The income of the ARA was briefly enhanced in 1904 and 1905 by £200 per annum from the Aberdeen County Council, and from 1909 to 1912, £100 per annum was received from the Scotch Education Department via the Aberdeen and North of Scotland College of Agriculture. After this, all state funding ceased.

In 1891 the ARA was reorganized, an executive committee of thirteen was established, and new subscribers were recruited, including H M The Queen, increasing the total to about 80. But financial problems continued. After the reorganization the highest level of annual subscription was just over £190, in 1896. Subscription income steadily declined to about £63 in

1913, the last year for which a financial statement is available.<sup>32</sup>

### III

The reports of the ARA, which give results of many varied investigations, are testimony to Jamieson's industry and enthusiasm, and suggest significant local influence. But a detailed account of the investigations, and an evaluation of the results and influence, cannot be attempted in this paper, where we must concentrate upon those investigations which were most important in connection with the development and fate of the organization.

Besides the work on insoluble phosphate and on finger-and-toe disease, there were seven other findings which Jamieson regarded as the ARA's most important contributions to agricultural science. These included the physical features of soil regulating fertility, the potential for improving yields by crossing different varieties of cereals and grasses, and the ability of rye grass to change its form. Jamieson also claimed that his microscopic studies showed the existence of an aperture in root hairs, and nitrogen-fixing hairs in plants.<sup>33</sup>

After the 'battle of the phosphates' it appears that the ARA's work did not arouse much interest among scientists elsewhere. Their attitude may be illustrated by the review in *Nature* of Jamieson's *Farmer's Handbook* (1905). Readers were told that Jamieson had been carrying on 'a series of agricultural experiments, or rather demonstrations' on a small scale, but in 'a very careful and neat fashion'. The book gathered the results and offered a 'brightly written résumé of the elementary facts connected with manures'. The reviewer continued:

<sup>30</sup> See 'Deputation to the Lord President of the Privy Council from the Sussex Association for the Improvement of Agriculture, 23 February, 1888', in *Annual Reports of the Proceedings of the Sussex Association for the Improvement of Agriculture, 1881-89*.

<sup>31</sup> 'Proceedings', Season 1889, in *Proceedings 1885-90*, pp 13-14.

<sup>32</sup> 'Organisation, object and work of the Aberdeenshire Agricultural Research Association; Committee Report', 1891, in *Proceedings 1891-99*, pp 4-8; *Proceeding of the Agricultural Research Association for 1913, 1914*.

<sup>33</sup> Jamieson, *Progress of Agricultural Science*, pp 74-5.

When ... we read that this or that fundamental fact has been discovered or proved ... much as though Mr Jamieson should tell us that he has discovered water is composed of eight parts of oxygen and one of hydrogen, we can only admire the innocence in which Mr Jamieson has managed to preserve his mind. Not for him the knowledge of good or evil that comes of reading other men's work ...<sup>34</sup>

Jamieson appears to have been considered more as a joke than a threat. However, his later work on nitrogen fixation was not just mocked, but was also attacked. Jamieson made a greater effort to publicize this work, which he regarded as his greatest achievement. Four reports of the ARA appeared between 1905 and 1911, entitled *Utilisation of Nitrogen in Air by Plants*.

In the pre-ambule to the first report, Jamieson rejected classic experiments by Lawes and by J B Boussingault, because the plants employed had been small and weak. He also rejected the view that root nodules of leguminous plants contained nitrogen-fixing bacteria, counterpoising the views of botanists who, he claimed, regarded the nodules as the product of fungal attack. Jamieson argued it was difficult to understand the productivity of prairies, and of pine forests on shallow soil, unless plants could fix nitrogen, and set about identifying the part of plants responsible for the process.

Jamieson claimed that staining techniques showed that protein formed at the ends of leaf hairs and travelled along the hair to the plant's vascular system. He found such 'albumen generators' on some part of all plants at some stage of development. He claimed that all green plants could fix nitrogen, but accepted that cereals needed nitrogen from the soil for maximum production.<sup>35</sup>

Under the heading 'A mare's nest' (an 'illusory discovery') the report was reviewed in *Nature* by 'A D H', who

commented that had Jamieson an 'elementary acquaintance with the manipulation of bacteria' he could easily demonstrate their existence in root nodules. He ridiculed the list of authorities who supposedly rejected the bacteria theory as 'equally amazing as regard either its inclusions, its omissions, or its spellings of proper names', and described the conclusions of the microscope studies as 'even more amazing'. The reviewer remarked that Jamieson's 'discovery'

... would be amusing were it not so dangerous and discreditable to the cause of scientific research. Mr Jamieson has a following ... there is a body of solid farmers and landowners who sit under him and take advice on practical matters which they suppose to represent the last word on science. Accustomed to the amenities of theological disputation, these men like their agricultural science in the same style; not the dry light of reason, but a strenuous assertion of a monopoly of the truth, rhetoric and passion, and a vigorous denunciation of the other side—all these they get from Mr Jamieson. But it is a windy diet, and sooner or later disagrees with the subject, whereupon science gets the blame.<sup>36</sup>

A D H quoted trials by Lawes and J B Gilbert, Lawes's successor as director of Rothamsted, but Jamieson replied with an alternative interpretation of this work and remarked that 'to show that plants fix free nitrogen is to undermine the work with which Rothamsted is chiefly identified'. He suggested that readers could assess the critique if they were aware that A D H was A D Hall, director of Rothamsted since 1902.<sup>37</sup> Hall replied

Mr Jamieson appears to suggest that Lawes and Gilbert ran the Rothamsted experiments as a sort of conspiracy to disguise the truth in favour of a prepossession of their own, and that after their death the body of scientific men who constitute the committee of management engaged the present director to continue the traditional fraud; this is a 'theory' which, like others of Mr Jamieson's, must

<sup>34</sup> 'Recent publications in agricultural science', *Nature*, 72, 1905, pp 324-5.

<sup>35</sup> T Jamieson, *Utilisation of Nitrogen in Air by Plants*, Aberdeen, 1905 (*Aberdeen Research Association Report*, 1905).

<sup>36</sup> A D H, 'A mare's nest', *Nature*, 73, 1906, pp 531-2.

<sup>37</sup> T Jamieson, 'Utilisation of nitrogen in air by plants', *Nature*, 73, 1906, pp 607-8.

require a robust confidence in the credulity of his disciples.<sup>38</sup>

In August 1906 Jamieson read a paper on the utilization of nitrogen to the British Association, but claimed that the chair cut him off before he had time to present the 'weight evidence' called for by his critics. He then faced a 'little army of carpers', to whom he did not have time to reply.<sup>39</sup>

'Weight evidence' was presented in Jamieson's second report on the utilization of nitrogen. Details were given of experiments in which plants gained nitrogen that, according to Jamieson, could only have come from the air. Jamieson claimed his findings had been well-received in America, Ireland, and on the continent. His first report had been republished in *Annales de la Science Agronomique*. Jamieson's third report included additional results of his own, and further evidence of the seriousness with which his discovery was treated abroad.<sup>40</sup>

The third report also included an account of Jamieson's attempts to obtain redress from the Board of Agriculture following the withdrawal of the Board's grant. When pressed, the Board had specified disapproval of the ARA's opinions on bacteria in nitrogen fixation. Regarding such a judgement as outwith the Board's competence, Jamieson appealed to every member of the Cabinet. The Prime Minister stated he was unable to interfere in a 'purely departmental matter'. Subsequently, Jamieson travelled to London to meet the President of the Board of Agriculture, Lord Carrington, who apparently withdrew the disapproval, but explained that the grant had been discontinued on the recommendation of an unidentified 'expert'. Since Carrington seemed unable to specify the reason for the

withdrawal of the grant more precisely, Jamieson claimed that this outcome 'may be held to meet all such unworthy attacks'.<sup>41</sup> This conclusion proved premature. Although Jamieson's fourth report on nitrogen fixation was able to cite corroboration of his weight data by Professors Pollacci and Mameli of Italy,<sup>42</sup> the 'unworthy attacks' continued.

#### IV

Jamieson's scientific positions not only led to his estrangement from the developing agricultural science establishment in England, but he also became estranged from the local centre of agricultural education despite his pioneering efforts in this field. From the 1880s, Jamieson fought a series of battles over the methods and orientation of agricultural education. His own policy was to avoid lecturing on agricultural practice to farmers, but to teach them the principles of chemistry, and the results of experiments.<sup>43</sup> He opposed the introduction of one-off practical 'extension' lectures, and a degree course in agriculture. These strongly held and expressed views led to Jamieson's loss of the Fordyce Lectureship when the Aberdeen University agricultural department was re-organized in the mid-1890s. Apparently, Jamieson's fate was due to pressure from the county councils and Board of Agriculture which funded the re-organization.<sup>44</sup> Nevertheless, the Aberdeen County Council provided the ARA with a grant in 1903 which was used to subsidize the *Farmer's Handbook*.<sup>45</sup>

In 1904, with further finance from the

<sup>38</sup> *Ibid*, p 56.

<sup>39</sup> T Jamieson, *Utilisation of Nitrogen in Air by Plants IV*, Aberdeen, 1911 (*Agricultural Research Association Report*, 1911), pp 32-4.

<sup>40</sup> See T Jamieson, *The Relation of Chemistry to Agriculture. A Lecture*, Aberdeen, 1878; *idem*, *Present Position of Agricultural Education in Scotland*, Aberdeen, 1891.

<sup>41</sup> Mr Thomas Jamieson; Jamieson, *Utilisation of Nitrogen in Air by Plants III*.

<sup>42</sup> J W Barclay, 'Report by the Committee, December 1904', in *Proceedings of the Agricultural Research Association 1900-04*, LSAA, xPer 630 Agr, p 12.

<sup>38</sup> A D H, 'Comment on utilisation of nitrogen in air by plants', *Nature*, 73, 1906, p 608.

<sup>39</sup> T Jamieson, *Utilisation of Nitrogen in Air by Plants II*, Aberdeen, 1906 (*Aberdeen Research Association Report*, 1906), p 34.

<sup>40</sup> Jamieson, *Utilisation of Nitrogen in Air by Plants III*.

county councils, the University department was transformed into the Aberdeen and North of Scotland College of Agriculture. Aberdeen County Council then withdrew its grant to the ARA, but suggested that the ARA might affiliate with the College.<sup>46</sup> In March 1906, however, after a discussion of a memorandum by Jamieson which emphasized that any arrangement would have to guarantee his scientific independence, the College governors declined to share their funds with an 'institution over which they have no control'.<sup>47</sup>

Further contact between the College and the ARA was initiated in 1908. After the Board of Agriculture grant was withdrawn, Jamieson approached the Scotch Education Department as a possible alternative source of funding.<sup>48</sup> The Department suggested that he ask the College for a grant, and Jamieson enjoyed sufficient support for an application to succeed: the governors voted by fifteen to seven to give the ARA £100 for 1909, from the funds that they received from the Scotch Education Department. Despite opposition, this was renewed each year from 1910 to 1912.<sup>49</sup>

When the Board of Agriculture withdrew its grant, Jamieson responded with persistent lobbying, and the matter was raised by his allies in the House of Lords in May 1909. But Carrington was unmoved, and quoted four authorities who rejected Jamieson's claims about nitrogen: the professors of botany at Edinburgh and Aberdeen, T H Middleton, former pro-

fessor of agriculture at Cambridge, who had recently joined the staff of the Board, and A D Hall.<sup>50</sup>

By this time, the establishment of the Development Fund had been mooted, and the ARA applied for £500 from this source in July 1910.<sup>51</sup> Jamieson was pessimistic when the application was referred to the Board of Agriculture,<sup>52</sup> and he was right to be wary. The Board advised the Development Commissioners that the reason for the withdrawal of the Board's grant, 'that the conclusions arrived at by Mr Jamieson as the result of his researches into the absorption of atmospheric nitrogen ... were ... regarded as erroneous by all scientific authorities ... applies equally to the present application'.<sup>53</sup> The commissioners hardly needed informing of this because they included Hall, who played a major role in the formulation of Development Commission policy.<sup>54</sup>

Jamieson was told in August 1911 that the commissioners were not prepared to make any grant to the ARA except in connection with a scheme submitted by the College.<sup>55</sup> However, such collaboration was never proposed by the ARA. At the end of 1911 the ARA's application to the College for its usual £100 grant involved a particularly bruising conflict. When objections were raised by Sir John Fleming, a governor appointed by the University,<sup>56</sup> Jamieson's attacks upon the College, Board of Agriculture, and Development Commission became steadily more vociferous. One memorandum to the governors headed 'Slander and Vindication of the Nitrogen Discovery' reprinted five

<sup>46</sup> J W Barclay, 'Report by the Committee, December 1905', in *Agricultural Research Association Report*, 1905.

<sup>47</sup> North of Scotland College of Agriculture Minutes and Proceedings, LSAA, xPer 630Nor [hereafter NSCA Minutes], Meeting, 16 March 1906.

<sup>48</sup> Scottish Record Office [hereafter SRO], AF 43/13 T Jamieson to J Struthers, 27 Feb, 11, 17 April, 6 July 1908; Agricultural Research Association [hereafter ARA] to Board of Agriculture [hereafter BA], 24 March 1908; T Jamieson, 'Confirmation of nitrogen fixation by plants. Attempt to stifle the discovery. Dishonourable conduct by a government board', 5 July 1908.

<sup>49</sup> SRO, AF43/13, J Struthers to T Jamieson, 15 April 1908; NSCA Minutes, Meetings, 30 Oct 1908, 19 Nov 1909, 25 Nov 1910, 21 March 1912. See also SRO, AF 43/22, Correspondence between the Scotch Education Department [hereafter SED], Jamieson and the College.

<sup>50</sup> *Parliamentary Debates, Lords*, 1909, I, col 1122-33.

<sup>51</sup> PRO, D2/1, ARA to Treasury, 27 July 1910.

<sup>52</sup> SRO, AF43/22, Treasury to ARA, 9 Aug 1910, T Jamieson to Lord Pentland, 10 Aug 1910, and manuscript notes summarizing the correspondence concerning the ARA application.

<sup>53</sup> PRO, D2/1, BA to Development Commission [hereafter DC], 29 May 1911.

<sup>54</sup> H E Dale, *A D Hall, Pioneer of Scientific Agriculture*, 1956.

<sup>55</sup> SRO, AF43/22, Treasury to T Jamieson, 11 Aug 1911.

<sup>56</sup> SRO, AF43/22, T Jamieson to the governors of the North of Scotland College of Agriculture [hereafter NSCA], 7 Dec 1911, 31 Dec 1911; NSCA Minutes, Meeting, 18 Jan 1912.



unanswered letters from Jamieson to Fleming.<sup>57</sup> In another memorandum prepared for MPs Jamieson complained that when his discovery had been announced 'no less than three Lecturers of the College – simultaneously as if under order – publicly denounced or disparaged it'.<sup>58</sup>

While the application for 1912 was reluctantly accepted, the ARA withdrew from further attempts to obtain government funding. In his final report on the utilization of nitrogen, Jamieson blamed the ARA's difficulties on

... two, or three, men in the south of England whose dislike has been aroused by our work, who are in constant touch with one another, and in influential touch with the central authorities ... 'aided and abetted' by two or three local men.<sup>59</sup>

The Development Commission, he asserted, had relegated the distribution of money for agricultural research to 'bodies of men who, in some cases, have no real sympathy with or knowledge of research, and who are too often guided by other feelings'. However, he asserted

It is not known that any material discovery has ever been made on this *collective plan*, or as a result of work to order; it has probably always been the result of individual work and devotion.<sup>60</sup>

After claiming that Rothamsted's results were 'useless and misleading' and the ARA's 'relative position as to results is highest in the kingdom', he asked:

Is it for an Association, with such a record, to put itself in a position of pleading with public bodies ... or, recognising them to be undiscerning and biased, to expose and censure them; and, being unable to compel, to leave them to their devices, and to silent contempt?<sup>61</sup>

Jamieson concluded that it was time for the ARA to 'preserve its dignity' by 'hold-

ing aloof' from the 'money patronage' of public bodies.

Jamieson's report for 1913 was the last published. He included an account of experiments on the sterilization of soil, which he intended continuing, but how much longer the ARA remained functional is unclear. In *Nature's Serious Tale*, published in 1926, two years after his death, Jamieson explained that the war 'put the voluntary support of the research work into abeyance'. The book was an attempt to report his final findings. Among other conclusions that he had arrived at were the views that 'The basis of vital action is not protoplasm but miniature embryos in albumen', and "'Sex" action is due to different states of oxidation'. He had returned to a religious faith, and was comforted by the thought that his ousting from the University, providing the leisure which made the discovery of nitrogen fixation possible, had been 'arranged by higher powers'.<sup>62</sup>

Jamieson was also comforted by a recent article in the *Proceedings of the Royal Society* which explicitly supported him. Benjamin Moore, FRS, of the National Institute of Medical Research, referred to the 'utmost care' that Jamieson had taken with his experiments and confessed that a 'careful perusal of the wealth of facts' published by Jamieson had convinced him 'in favour of the assimilation of nitrogen from the air by the green cell'.<sup>63</sup> In the long term, of course, there was no shift in consensus in favour of Jamieson's theories.

## V

While the failure of its application to the Development Commission contributed to the demise of the ARA, an application by its local rival succeeded and led eventually

<sup>57</sup> SRO, AF43/22, T Jamieson to the governors of NSCA, 31 Dec 1911.

<sup>58</sup> SRO, AF43/22, T Jamieson, Document prepared for leading Members of Parliament, nd.

<sup>59</sup> Jamieson, *Utilisation of Nitrogen in Air by Plants IV*, p 53.

<sup>60</sup> *Ibid*, p 62.

<sup>61</sup> *Ibid*, p 59.

<sup>62</sup> T Jamieson, *Nature's Serious Tale*, Aberdeen, 1926, p xvi.

<sup>63</sup> B Moore and T Arthur Webster, 'Studies of photo-synthesis in fresh-water Algae', *Proceedings of the Royal Society*, Series B, 91, 1920 pp 201-15.

to the establishment of the Rowett Research Institute. But even for the College, extracting funds from the Commission was not straightforward.

The governors of the Aberdeen College, along with those of the other Scottish agricultural colleges, first applied to the Commission in October 1910, for grants to purchase farms for instruction and research.<sup>64</sup> The Aberdeen application included £5000 to cover buildings and equipment for experimental work 'particularly in the Feeding and Breeding of Farm stock'.<sup>65</sup> The applications were rejected on the grounds that the provision of farms was not covered by the act,<sup>66</sup> but this policy was soon revised: by March 1911 it was agreed that farms could be funded as long as half the costs were raised locally.<sup>67</sup> This led to negotiations to purchase Craibstone farm, north-west of Aberdeen, which were not completed until 1914.

The pursuit of Development Fund grants for *research* was taken over by the Scotch Education Department. The Highland and Agricultural Society convened a meeting of representatives of the agricultural and veterinary colleges, which supported a proposal of the Department to appoint an expert committee to advise on Scotland's agricultural research requirements.<sup>68</sup> In April 1911 the Development Commissioners were informed of a 'strong feeling ... that a grant ... for the purpose of aiding research in relation to Scotland should be allocated to Scotland separately'.<sup>69</sup> The commissioners deprecated the proposal to appoint a Scottish advisory committee, and commented that if the Scotch Education Department was concerned with 'scientific research proper (as distinct from

the application of known facts to local conditions)' then any scheme should take account of what was being done elsewhere in the UK.<sup>70</sup>

In early 1911 the commissioners had appointed their own advisory committee charged with producing a programme of agricultural research. Hall was the key member of this committee, which entered into negotiations with the Board of Agriculture, whose own advisory committee, chaired by Middleton, had already proposed a scheme.<sup>71</sup> The Board favoured concentrating initially upon providing qualified research workers, and developing strong teaching institutions at which research would be expected. This focus on teaching institutions tended to exclude Scotland from the Board's plans, as the Scotch Education Department had taken over the administration of funds for agricultural education in Scotland in 1896. In contrast to the Board's emphasis on educational institutions, the Commission favoured a more direct route to the development of agricultural research and envisaged the creation of a series of new institutes. A compromise was agreed at a meeting between Middleton and Hall in June 1911. The agreed plan retained the new institutes, but in most cases they were closely associated with teaching institutions.<sup>72</sup> In the proposals regarding the remit and location of the institutes there was only one mention of Scotland: animal nutrition would be covered partly by Cambridge University 'leaving one other institute to be settled later, possibly in Scotland'.<sup>73</sup> Cambridge was confirmed as the site for an Animal Nutrition Institute in August 1911: £14,500 was granted, the

<sup>64</sup> PRO, D2/3, 'Application by the governors of the Aberdeen and North of Scotland College of Agriculture to the Development Fund', 28 Oct 1910.

<sup>65</sup> *Ibid.*

<sup>66</sup> PRO, D2/3, DC to SED, 12 Jan 1911.

<sup>67</sup> NSCA Minutes, DC to SED, 2 March 1911, SED to NSCA, 10 March 1911, in Meeting, 16 March 1911.

<sup>68</sup> NSCA Minutes, Meeting, 16 March 1911.

<sup>69</sup> PRO, D2/3, SED to DC, 24 April 1911.

<sup>70</sup> PRO, D2/3, DC to SED, 5 May 1911.

<sup>71</sup> PRO, MAF 33/63, A13129/1910.

<sup>72</sup> PRO, MAF 33/72/A21599/1914; T H Middleton, Memorandum, 30 Dec 1914; see also T DeJager, 'Pure science and practical interests: the origins of the Agricultural Research Council, 1930-1937', *Minerva*, 31, 1993, p 133, and Olby, 'Social imperialism', p 152.

<sup>73</sup> PRO, D2/1, Memorandum on a meeting, 6 June 1911.

commissioners waiving the standard condition that one-half of the capital was to be raised from local sources, and building began in early 1913. The co-directors of the Cambridge Institute were professor of agriculture T B Wood and biochemist F G Hopkins, but Hopkins lost interest in the venture after he was appointed to a chair of biochemistry.<sup>74</sup>

The Scotch Education Department was disappointed, arguing 'a useful if not indispensable preliminary ... would have been a careful enquiry as to the subjects ... of special value to the agricultural community in Scotland' but commented that the north-east would be suitable for animal nutrition investigations.<sup>75</sup> However, responsibility for agricultural research was about to be transferred to a Board of Agriculture for Scotland, created under the Small Landholders (Scotland) Act (1911). The Development Commissioners then argued that the purpose of the new Agriculture (Scotland) Fund, worth £200,000, was similar to that of the Development Fund, and should be exhausted before Scottish applications could be considered.<sup>76</sup> When it was explained that the Scottish fund was for land resettlement schemes,<sup>77</sup> the commissioners suggested that payments from the Development Fund for Scottish purposes might be considered loans, to be re-paid if the land resettlement programme proved less expensive than anticipated.<sup>78</sup> This arrangement was not finally agreed until February 1912.<sup>79</sup> Since, after Hall, one of the most influential participants in these discussions was Scottish, T H Middleton, whose initial training was at Edinburgh University, it is perhaps

surprising that there was not a more sympathetic attitude towards Scottish needs. Presumably, having left Scotland after graduating BSc (Agriculture) in 1889, Middleton's sympathies were now primarily with English institutions such as Cambridge University, where he had served as professor of agriculture, 1902-1906, and the Board of Agriculture.<sup>80</sup>

During 1911 and 1912 the Aberdeen governors were engaged in the purchase of Craibstone farm, the formulation of a constitution, adopted in March 1912 (after which 'Aberdeen' was dropped from the name of the College), and the creation of a chair of agriculture, to which James Hendrick was appointed in May.<sup>81</sup> In August Hendrick told the governors that it was necessary to 'at once push forward' with the research application. He set out a modest scheme involving capital expenditure of £3210 and recurrent expenditure of £420. Hendrick advised that it was unlikely that the commissioners would support research 'on more than one main group of subjects' and suggested that the research should focus on animal nutrition and animal husbandry. However, some of the governors were concerned that other subjects should also be supported. The principal of Aberdeen University suggested 'it would be inimical to the scientific interests of research if it were confined to one department'.<sup>82</sup>

Hendrick's scheme revived the application at a time when a proposal, supported by the Board of Agriculture, had been made that the second animal nutrition institute should be established in Leeds instead of Scotland.<sup>83</sup> In November 1912, the chair of the governors' sub-committee dealing with research, explained that thinking it had been agreed that an animal

<sup>74</sup> See M Weatherall, 'The foundation and early years of the Dunn Nutritional Laboratory', in D F Smith, ed, *Nutrition in Britain: Science, Scientists and Politics in the Twentieth Century*, 1997, pp 29-52.

<sup>75</sup> PRO, D2/3, SED to DC, 12 Aug 1911.

<sup>76</sup> SRO, AF43/1, DC to Board of Agriculture for Scotland [hereafter BAS].

<sup>77</sup> SRO, AF43/1, BAS to DC, 4 June 1912.

<sup>78</sup> SRO, AF43/1, DC to BAS, 1 July 1912.

<sup>79</sup> SRO, AF43/1, BAS to DC, 17 Feb 1913, DC to BAS, 26 Feb 1913.

<sup>80</sup> E J Russell, 'Thomas Hudson Middleton 1863-1943', *Obituary Notices of Fellows of the Royal Society*, 4, 1944, pp 555-69.

<sup>81</sup> NSCA Minutes, Meetings, 21 March and 16 May 1912.

<sup>82</sup> NSCA Minutes, Meeting, 8 August 1912.

<sup>83</sup> PRO, D2/6, BAS to DC, 16 Aug 1912.

nutrition institute would be established in Aberdeen, further action was suspended while negotiations regarding Craibstone were underway. Hearing that 'there was a likelihood of ... loosing this nutrition grant - that it was to be taken to England',<sup>84</sup> an application was hurriedly sent to the Development Commission, via the Board of Agriculture for Scotland. This was more ambitious than Hendrick's proposal, involving capital expenditure of £4-5000 and recurrent expenditure of £1900. The proposed programme included research on the chemistry of food-stuffs, and the nutritive values of food constituents and Scottish farm foods. J Arthur Thomson, professor of zoology, was to study 'the effect of nutrition upon sex and inheritance' while Hendrick was to investigate the use of milk substitutes for feeding young animals. In addition, it was explained that although the governors 'regard research in animal nutrition as the most important part of the work to be undertaken ... there are other branches of research which are of great importance to the district'. These 'minor investigations' were a study of soil drainage losses and manure-making, by Hendrick, and some experiment that the professor of botany wanted to carry out.<sup>85</sup>

At the end of November the commissioners agreed to grant Leeds University £1000 towards animal nutrition research. The Aberdeen application was also before the meeting, but the commissioners were not yet ready to consider it in detail. A report on research in the Scottish universities by two of their members, Hall and Sir William Haldane, crown agent for Scotland was also on the table, and the commissioners simply agreed, in principle, that 'on receipt of suitable applications' £1500 per annum could be granted to each of the

Scottish agricultural colleges.<sup>86</sup> At the following meeting at the suggestion of Hall and Haldane, the commissioners decided to advise the North of Scotland College of Agriculture that a joint committee of the College and the Aberdeen University should be formed to supervise the proposed research.<sup>87</sup>

## VI

Both the University court and the College governors agreed to appoint four representatives each to a joint committee. At this time only four of the 45 governors represented Aberdeen University, so the arrangement greatly enhanced the role of the University in the agricultural research scheme. The governors appointed their chairman, Mr James Campbell, commissioner to the Countess of Seafield and representative of Banff County Council, Mr R H N Sellar, implement maker, and Robert Wilson, MD, both representatives of Aberdeen County Secondary Education Committee, and William Bruce, MD, retired medical officer of health for Dingwall, a co-opted member of the governors.<sup>88</sup> The University court appointed the principal, Sir George Adam Smith, Matthew Hay, professor of forensic medicine and public health and medical officer of health for Aberdeen, Colonel William Johnston, retired army medical officer and an assessors of the court, and H M MacDonald, FRS, professor of mathematics.<sup>89</sup>

Before the committee met, the Commission advised that £1000 would be made available for research in 1913-14, plus an additional £500 if £500 could be raised from other sources, provided a suit-

<sup>84</sup> 'College of Agriculture The Craibstone Grant,' nd, Press cuttings file 1913-1920, pp 14-15, LSAA. See also NSCA Minutes, Meeting, 21 Nov 1912.

<sup>85</sup> PRO, D2/10, BAS to DC, 21 Oct 1912; Application by the governors of the North of Scotland College of Agriculture', Oct 1912.

<sup>86</sup> PRO, D1/1, DC Meeting, 28 Nov 1912.

<sup>87</sup> PRO, D1/1, DC Meeting, 19 Dec 1912; PRO, D2/10, DC to NSCA, 1 Jan 1913.

<sup>88</sup> NSCA Minutes, Meeting, 27 Feb 1913.

<sup>89</sup> Rowett Research Institute, Minutes book of joint committee on research in animal nutrition, volume 1 [hereafter RRI Minutes], Extract from Aberdeen University Court Minutes, 11 March 1913.

able scheme of research was submitted. It was also specified that 'it would be best if, for the present, research carried on in Aberdeen were not necessarily confined to one particular subject, but included other investigations of permanent scientific value having their origin in local requirements' and that 'in undertaking ... any research the College should communicate freely with the institute specially concerned with the subject'.<sup>90</sup>

When the committee met in May 1913, Smith was appointed chairman and a scheme prepared by Hendrick and Thomson was presented. This was revised and submitted to the Commission, and proposed that a 'Bio-chemist' should be appointed to work in co-operation with Hendrick, and that five projects would be carried out – on 'Factors determining fertility and sex', 'Soils and drainage', 'Heavy root feeding and dung making', and 'The nitrogenous constituents of turnips'.<sup>91</sup>

The programme was approved apart from the project on fertility and sex which the Commission regarded as 'too extensive and abstract a question to be considered as a subsidiary subject in a Department of which the main present object is work in Animal Nutrition'.<sup>92</sup> Capital of £807 and £905 recurrent expenditure would be available, provided the senior officer appointed met with the approval of the Board of Agriculture for Scotland, and that the scheme was discussed with and approved by those working on animal nutrition in Cambridge and Leeds. A further £95 would be provided if a suitable project 'more based on local requirements' was proposed as an alternative to the one rejected.<sup>93</sup> The committee successfully responded with a proposal to study 'Isle of Wight Bee Disease', which was causing problems for honey producers in

Scotland.<sup>94</sup> The named projects were underway by the end of 1913.

The committee advertised for a bio-chemist in October 1913 and by early November eight applications had been received. However, Hendrick and Smith placed an alternative name before the committee, E P Cathcart, lecturer in physiological chemistry at Glasgow University, and undertook to ascertain what salary Cathcart would require.<sup>95</sup> It is not known how Cathcart's name came to the attention of Hendrick and Smith, but it may be significant that the applications to the Development Commission of October 1910 included a proposal from the West of Scotland College for studies of nitrogen metabolism and the construction of a respiration calorimeter,<sup>96</sup> two of Cathcart's main interests.<sup>97</sup> Smith interviewed Cathcart and spoke to D N Paton, professor of physiology at Glasgow, but it seemed that Cathcart was unwilling to go to Aberdeen for the salary on offer, £450, or to give up his existing work, in view of the possibility of a chair of physiology. But Smith received a suggestion that Cathcart's junior colleague, John Boyd Orr, a Glasgow graduate in medicine and physiology and a research scholar in Paton's department, would be a suitable candidate.<sup>98</sup> Orr and Allen Neville, an agricultural chemist of the School of Agriculture, Cambridge, appeared before the committee in mid-January 1913. Orr was selected and appointed from 1 April 1914.<sup>99</sup>

After Orr arrived in Aberdeen, the construction of an animal nutrition laboratory was begun at Craibstone, while Orr worked at the College of Agriculture and the physiology department of the

<sup>90</sup> RRI Minutes, DC to NSCA, 4 March 1913.

<sup>91</sup> RRI Minutes, JC Meeting, 2 and 16 May 1913.

<sup>92</sup> RRI Minutes, DC to JC, 8 Sept 1913, JC Meeting, 26 Sept 1913.

<sup>93</sup> PRO, D1/1, DC Meeting, 26 June 1913.

<sup>94</sup> PRO, D2/10, Aberdeen University [hereafter AU] to DC, 11 Nov 1913, DC to AU, 31 Oct 1913.

<sup>95</sup> RRI Minutes, JC Meeting, 6 Nov 1913.

<sup>96</sup> PRO, D2/3, Application from the West of Scotland College of Agriculture, 24 Oct 1910.

<sup>97</sup> See R C Garry, *Life in Physiology* (ed D F Smith), Glasgow, 1992.

<sup>98</sup> RRI Minutes, JC Meeting, 20 Nov 1913.

<sup>99</sup> RRI Minutes, JC Meeting, 15 Jan 1914.

University. He continued work begun in Glasgow on the influence of water ingestion on the excretion of the metabolites creatin and creatinin in urine, using human subjects.<sup>100</sup> Before the laboratory was completed however, Orr joined the Royal Army Medical Corps and research on animal nutrition was effectively suspended for the duration of the war. During the war the soils and drainage project was troubled by loss of staff and by technical problems, but the work on Isle of Wight Bee Disease made progress, and was rewarded by additional private and Development Commission funding.<sup>101</sup> The soil research was handed over to the College in 1921,<sup>102</sup> as was the bee disease work a year later.<sup>103</sup>

Orr returned to Aberdeen as a war hero and resumed his duties in February 1919, vigorously setting about the establishment of an animal nutrition research institute, of which he was designated director. The Development Commission agreed to match locally-raised funds, and the committee set about fund raising. John Quiller Rowett, a school friend of R H A Plimmer, a biochemist who was recruited to the staff, first offered £500 towards the construction of experimental animal stalls.<sup>104</sup> Rowett was a London-based businessman who had thrived during the war, and following a meeting with Orr he increased his offer to £10,000. This meant the committee could plan an initial expenditure of up to £20,000. The committee asked Rowett to allow his name to be associated with the institute, and when Rowett agreed, he expressed the hope that the institute would 'give valuable results in the subject of Animal Nutrition and, in due course ...

Human Nutrition and public health generally'.<sup>105</sup> Much was made of this point in the *First Report* of the Institute, issued in December 1922. It was claimed that 'probably the greater part ... of the ill-health of human beings is due ... to nutritional disorders' and that much of the research to be carried out would be applicable to humans. Rowett was said to have made the 'enlightened and humane suggestion' when giving his 'munificent donation' that when there were 'indications that work in certain directions might throw light on human nutritional disorders, this work might be allowed to carry on, even though it had no direct bearing on the feeding of farm animals'.<sup>106</sup>

## VII

This paper has been prepared as part of a larger project on the history of nutrition science during the twentieth century, a history in which a major role was played by Orr and the Rowett. The story of the rise and fall of the ARA helps both to highlight the challenges that Orr faced, and to elucidate the circumstances of the origins and early development of the Rowett.

Both the ARA and the Rowett were located at the centre of the same large agricultural region far from the decision-making centres in Edinburgh and London. The worlds of both Jamieson and Orr were populated by landowners, farmers, industrialists, politicians, civil servants and scientists. Both faced the problems of raising funds and of relating not only to the distant government bodies, but also to the local educational, scientific, social, and agricultural establishments. While in Orr's era more government funding was available, the success of applications for funds towards

<sup>100</sup> J B Orr, 'The influence of excessive water ingestion on protein metabolism', *Biochemical Journal*, 8, 1914, pp 530-40.

<sup>101</sup> RRI Minutes, JC Meeting, 31 Oct 1918.

<sup>102</sup> RRI Minutes, JC Meeting, 28 Sept 1921. Eventually, in 1930, the Macaulay soil research institute was established in Aberdeen with Development Commission backing: Russell, *Agricultural Science*, pp 452-8.

<sup>103</sup> RRI Minutes, JC Meeting, 5 Oct 1922.

<sup>104</sup> RRI, JC Minutes, 12 Feb 1920.

<sup>105</sup> RRI, Rowett to Smith, 8 March 1920; JC Minutes, 15 March 1920. See also J B Orr, *As I Recall*, 1966, pp 91-2.

<sup>106</sup> Rowett Institute, *First Report*, Aberdeen, 1922, pp 17-18. Two years later Rowett committed suicide, after a serious downturn in his business fortunes: 'Obituary', *Aberdeen University Review*, XII, 1925, p 95.

capital expenditure still depended upon success in raising funds from private sources.

The ARA appears to have been the product of co-operation between one chemist, and a group of aristocratic land-owners, agricultural manufacturers and suppliers, and politicians with a range of formal affiliations, with farmers cast largely in the role of consumers of the knowledge that the Association was created to produce.<sup>107</sup> The ARA may be regarded as representative of progressive opinion of the late Victorian period: the organization favoured state support of research, and Jamieson's writings show an impulse to modernize agriculture, to disrupt the established rhythms of the countryside, and to introduce the methods of science and the social organization of the town.

From the beginning Jamieson and the ARA cast themselves as outsiders and challengers to the nascent agricultural science establishment in the south of England, but after the 'battle of the phosphates', and while state funding for agricultural research was relatively modest, it appears to have been largely assumed that these challenges could be safely ignored. But as the scientific challenges became more fundamental, and more vigorously pursued, and when the prospect of much more extravagant expenditure by the state became apparent, Jamieson's claims were taken more seriously: steps were taken to discredit his claims and to remove the respectability that was conferred upon the ARA by an annual government grant. Jamieson's aristocratic allies proved powerless to reverse these

setbacks: by this time, the agricultural scientific-administrative establishment was becoming firmly entrenched. However, Jamieson and the ARA retained sufficient indigenous support for a small grant to be obtained, for a while, from funds administered locally.

But the difficulties faced by Jamieson and the ARA and may not be explainable entirely in terms of reaction to their maverick activities. The resistance of the Development Commission to the independent planning of agricultural research in Scotland, the single mention of Scotland in the plan agreed by the Commission and the Board of Agriculture, and the reluctance to allow Scottish applications to the Development Fund for agricultural research, all suggest an attempt by the central agricultural research establishment to retain research funds close to home, and a general suspicion of the periphery.<sup>108</sup>

The prevarication of the Development Commission over the Aberdeen College's application, and the support of the Board of Agriculture and the Commission for the establishment of animal nutrition research at Leeds, may be further examples of the commissioners' attitude towards research in Scotland. However, these features of the story, as well as the particular conditions applied to Aberdeen, the formation of the joint committee and the need to consult Cambridge and Leeds, may have been the result of perceptions specifically concerning the situation in Aberdeen – conditioned by past conflicts of the Board of Agriculture and the Development Commission with Jamieson, and by the support that Jamieson still appeared to retain among some of the governors of the College.

<sup>107</sup> There is much potential for further research into this organization. The investigation of the precise interests of manure manufacturers in the north-east of Scotland in promoting the use of ground mineral phosphates, for example, might further elucidate the nature of the alliance of interests upon which the organization was originally based. The formation and survival of the Association, as well as the financial difficulties that it faced, and the advent of governmental support, owed much to the agricultural depression of the late nineteenth century. But whether, how, and to what effect, the ARA influenced farming practices in the north-east of Scotland and beyond, awaits further research and analysis.

<sup>108</sup> This notion is reinforced by the history of the DC-supported plant breeding institutions: the DC resisted the establishment of a plant breeding institute near Edinburgh, preferring to have a single institute in Cambridge. See P Palladino, 'The political economy of applied research: plant breeding in Great Britain, 1910-1940', *Minerva*, 28, 1990, p 460.

Just as the development and activities of the ARA depended very much upon the initiative of Jamieson, the development of the Rowett depended very much upon the initiative of Orr, but Orr proved much more effective than Jamieson in building and using powerful alliances both at the centre and locally. After the war Orr was still required by the Development Commission to consult T B Wood, who had become the sole director of the Animal Nutrition Research Institute in Cambridge.<sup>109</sup> But Orr enjoyed a good relationship with Wood and therefore this association worked to his advantage. Wood, in turn, was close to Middleton and Hall.

Jamieson sought to create an identity for the ARA by developing unique scientific positions; similarly, Orr attempted to develop a distinct research programme at the Rowett. But while Jamieson's unique positions implied continual challenge to and conflict with the most significant figures in the south, Orr developed a programme which brought him into an alliance with Wood. The Rowett took up a concerted programme of research on the role of minerals in nutrition,<sup>110</sup> challenging the enthusiasm for the newly-discovered accessory food factors or vitamins which had arisen among some scientific, medical and agricultural circles, following the work of F G Hopkins and others. However Orr's sceptical position on vitamins was shared with Wood,<sup>111</sup> and also with his former colleagues in Glasgow.<sup>112</sup>

During the 1920s Orr also formed a valuable alliance within central government with Walter Elliot, MP, one-time researcher at the Institute, who was Under-Secretary of State for Scotland in the Conservative government of 1926-29 and later Minister of Agriculture and Fisheries, Secretary of State for Scotland and Minister of Health. This connection brought the Rowett additional sources of public funding for research in both human and animal nutrition from the Empire Marketing Board.<sup>113</sup>

While the intended function of the joint committee may have been to help ensure the effective deployment of Development Commission funding, it brought together a group of influential men at the periphery who helped to create a greater degree of autonomy from the government decision-making and funding bodies than otherwise would have been the case. Orr enjoyed a good relationship with the joint committee which helped him to pursue his objectives. The support of men such as the principal of Aberdeen University was of great assistance in Orr's money-raising efforts. In addition, when Orr's two most senior members of staff opposed the focus upon minerals and the sceptical position on vitamins, his support by the joint committee was such that the outcome of the ensuing conflicts resulted in the resignation of his most senior member of staff and the termination of the employment of the second most senior.<sup>114</sup>

The work on minerals, which addressed problems of human as well as animal nutrition highlights a dimension to the work of the Rowett which was not available to the ARA. Such work was directed towards the medical profession as well as to agriculture: Orr's world was also popu-

<sup>109</sup> The plans for building of animal nutrition research facilities at Leeds were suspended during the war, and in 1919, the key worker, C Crowther, left Leeds: see PRO, MAF 33, 17/TE1756, 17/A21385/1915, 17/TE1757 and Russell, *Agricultural Science*, p 253. The failure of the Leeds scheme may partly explain why the development of animal nutrition at Aberdeen became more straightforward after the war.

<sup>110</sup> D F Smith, 'The early institutional and scientific development of the Rowett Research Institute' in A Adam, D F Smith and F Watson, eds, *To the Great Support and Advancement of Helth*, Aberdeen, 1996, pp 45-53.

<sup>111</sup> See Orr, *As I Recall*, p 107; Weatherall, 'Dunn Laboratory', pp 32-3.

<sup>112</sup> See D F Smith and M Nicolson, 'The "Glasgow School" of Paton, Findlay and Cathcart: Conservative thought in chemical physiology, nutrition and public health, *Social Studies in Science*, 19, 1989, pp 195-238.

<sup>113</sup> See Orr, *As I Recall*, pp 90, 109-11.

<sup>114</sup> D F Smith, 'Establishing a position: John Boyd Orr, the Rowett Institute and minerals in nutrition: internal struggles 1920-32', paper given at a conference at Aberdeen University, 1 July 1995. This paper is currently being prepared for publication.



lated by medical scientists, administrators and practitioners. As we have seen, Orr was medically-qualified. The composition of the joint committee also facilitated this dimension of the Rowett's work. Matthew Hay, medical officer of health for Aberdeen was an original member of the joint committee and he was later joined by J A MacWilliam, professor of physiology at the University of Aberdeen.

While, like Orr, Jamieson favoured state funding, Jamieson consistently emphasized the need for independent work by scientists, and expressed the view that scientific advance was most likely to be the product of hard work by solitary scientists. The ARA's applications to the College of Agriculture and the Development Commission were simply for funds to subsidize the organization, rather than to advance particular research programmes. Due to the changed funding situation, Orr was able to plan research on a much larger scale. In assembling a group of researchers

committed to the programme of research on minerals in nutrition Orr consistently deployed the ideology of teamwork in science,<sup>115</sup> in line with the ideology which may be found in Development Commission documents,<sup>116</sup> and in writings of men such as Hall.<sup>117</sup> In this emphasis on teamwork, there is a striking contrast with the views of Jamieson. Orr enthusiastically embraced collectivism in science and was willing and able to develop the networks necessary for him to take advantage of the opportunities offered by the increasing state support for science of the twentieth century.

<sup>115</sup> See, for example, the document prepared by Orr proposing the development of an animal nutrition research institute: PRO, D2/26, Memorandum reasons for drafting and submitting scheme, June 1919.

<sup>116</sup> For example, the DC's report for 1920 quoted a memorandum submitted to the Treasury in Aug 1911 which emphasized the value of 'collaboration upon a single question of several men differently equipped': *Tenth Report of the Development Commissioners for the Year ended the 31 March 1920*, 1920, p 19.

<sup>117</sup> See, for example, A D Hall, 'The present position of research in agriculture', *Jnl Roy Soc Arts*, LXIX, 1921, pp 300-12.