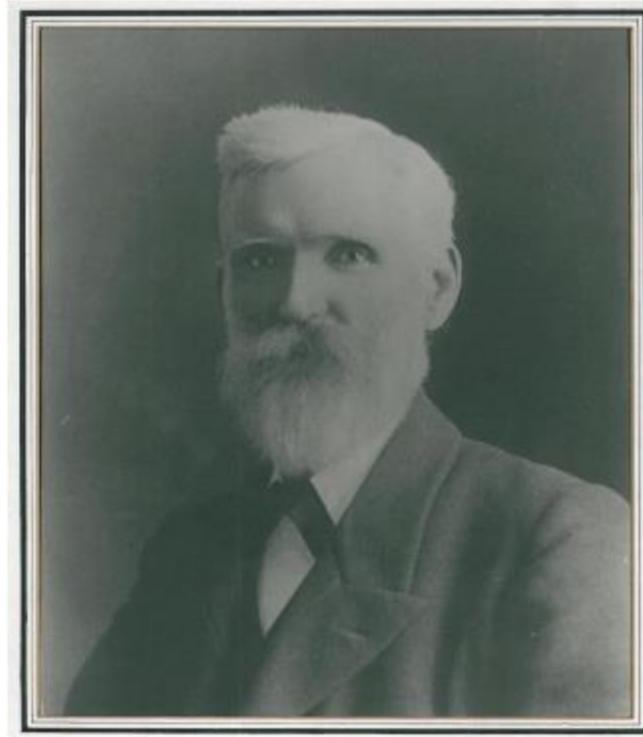


D.G. Parbery (15th April 2015)



DANIEL M^cALPINE
Father of Australian Plant Pathology
1849-1932

Synopsis

Daniel McAlpine, a Scot, migrated to Australia in 1884, where between 1890 and 1911 he earned the title of *The Father of Australian Plant Pathology*. His was the first appointment as a Plant Pathologist in the British Empire. He became a world figure, acknowledged for his role in establishing plant pathology as a discipline in its own right, and he fulfilled major roles in establishing and leading two large collaborative nationwide investigations of plant diseases of national importance in Australia. His partnership with William Farrer in reducing the impact of cereal rusts won world acclaim, but sadly his success in reducing the national impact of bitter pit on the nation's apple crops undeservedly ended his career. It pushed him into near obscurity for over fifty years until the founding of the Australasian Plant Pathology Society in 1969.

McAlpine in Britain

Daniel McAlpine was born in Dalry, Scotland on 21st January 1849. He grew up in Saltcoats and was educated in nearby Ardeer where his father was Schoolmaster, where Daniel learned to speak Greek and Latin and to read French and German. He was then a pupil teacher at Adeer School laying the foundations of a successful 36-year teaching career.

At 21, he became a clerk at an ironworks in Cumnock, which led him towards the possibility of a career in geology. In 1873, he and his younger brother Archibald enrolled at the Royal College of Science, London where Daniel took geology, mineralogy, palaeontology, organic- and inorganic chemistry. From 1874 the brothers also studied biology and botany. By August 1875 Daniel had excelled in all subjects and qualified to take out his degree, but chose not to graduate, which he later regretted.

Lectures in botany and biology from Sir William Thiselton-Dyer and Sir Thomas Huxley redirected their interests to biological sciences. Much of 1875 to 1876 was spent preparing labelled watercolour illustrations and explanatory texts for a *Biological Atlas* published in 1880 for use in practical classes. Daniel worked in Huxley's laboratory and Archibald with Professor McNab in Dublin. Daniel produced seven atlases and two textbooks between 1877 and 1884. The significance of the atlases was that prior to McAlpine's publications, the best texts were available only in German (Walters 1989).

In 1875, Daniel was appointed lecturer in agriculture, biology, botany and geology at the Watt Institute and School of Arts, Edinburgh. The importance of McAlpine's contribution to the education of British students has previously been overlooked. Students praised his lectures, admired his knowledge and valued the beautifully illustrated teaching texts and atlases. His lectures caught and held the interest of students and won their respect and affection. When he married Isabella Williamson in 1878, his students presented him with a purse of sovereigns. Arthur Conan Doyle, the author of the Sherlock Holmes stories, attended McAlpine's lectures in botany in the Pharmacy Department of the Edinburgh Medical School, became a friend and corresponded with him for over 40 years.

Australia and Opportunity

As Daniel and Isabella's family grew, his meagre salary, even supplemented by fees for lectures in the Pharmacy Department of the Edinburgh Medical School, the University's Botany School and the Edinburgh Veterinary College, plus sales of books and charts, was insufficient to support the family. In early 1884, following the death of their infant son John, McAlpine and Isabella left for Tasmania. However, after stopping at Hobart, they continued to Melbourne.

The family settled in Powlett St., East Melbourne, and Daniel was soon teaching at Kew High School. Meanwhile he sought help from the Victorian Premier to obtain an academic post. He was thus hired to provide practical classes in botany at Ormond College to bolster the course taught by the ageing Professor McCoy, and did so for five years. In 1886 he began teaching botany to students at the Victorian College of Pharmacy, including lectures, practical classes and excursions, which he did for almost 26 years. The tributes paid to him by his past pharmacy students provide a wonderful portrait of him (Anon 1932a).

In 1889 a severe wheat rust epidemic swept the country, causing losses estimated at \$300,000,000 to \$500,000,000 in today's dollars (Fish 1970). The Government of Victoria decided that direct action was needed to deal with such diseases and agreed to appoint a vegetable pathologist. Alfred Deacon, Victorian Minister for Water Supply and Agriculture, was well aware of McAlpine's ability, and proposed his appointment as Victoria's Vegetable Pathologist. Before McAlpine's formal appointment on 12th May 1890, the Australian Association for the Advancement of Science [AAAS] decided to run a series of Inter-colonial conferences to investigate the possibility of controlling wheat rust. Baron von Müller, co-founder

of the AAAS, formed a steering committee to draft a research proposal to be put to the conference held in Melbourne in March 1890. Von Müller, as Chairman, selected McAlpine and two others to draft the proposal which, when put to the conference in March, was adopted with few minor amendments.

McAlpine was not at the Melbourne Conference but attended all the others. At the Sydney conference the following year he met William Farrer with whom he worked closely over the following 16 years, testing the resistance of Farrer's wheat selections under a range of environments. He attended the conferences in Adelaide in 1892, Brisbane 1894, and chaired the final meeting in Melbourne in 1895. He continued to oversee the nationwide program until 1911. This Australian initiative attracted international attention and great respect for those who led it (Large 1940).

In 1890, viruses and other sub-cellular pathogens were unknown, bacterial and nematode plant diseases were known but few were studied. On the other hand, fungi had been recognised as important plant pathogens since the mid 19th century. Therefore, McAlpine set about gathering all available literature on fungi associated with plants in Australia. He examined numerous Australian fungi found on early plant collections made by explorers of the 18th and 19th centuries, which were sent to him from the Kew Herbarium.

Renowned Mycologist-Plant Pathologist

During his 21 years as consulting vegetable pathologist, McAlpine pioneered a branch of science which flew in the face of the belief that plant diseases were due to the vagaries of weather, especially warm, wet spells (McAlpine 1910a). During the early part of the 1890s, in addition to his involvement in the cereal rust program, he set about proving to farmers, horticulturalists and politicians that most plant disease problems were caused by fungi and, in horticultural crops especially, could be controlled with fungicides. He invited growers to inspect plots where fungicides had been applied compared to control plots. He held field days and lantern slide lectures showing the presence of fungal hyphae and fruiting bodies in diseased tissue and the symptoms they caused.

He compiled the *Systematic Arrangement of Australian Fungi*, published in 1895, as a diagnostic aid and ready reference to the literature on Australian plant-associated fungi. Much of this was gathered from his own study of specimens collected since 1770 by early European explorers, provided by the Kew Herbarium as noted above. The rest were collected from an extensive search of the literature. By 1911 McAlpine's mycological herbarium held in the order of 10,000 specimens. His collection laid the foundation of the Victorian Plant Research Institute [VPRI] herbarium, which has been added to over the years. From about 1970 Dr. Ian Pascoe reorganised McAlpine's Herbarium and continued its expansion, creating what is now an invaluable, much-used national resource. McAlpine's mycological expertise matched his international reputation as a plant pathologist. He made accurate notes, illustrations of all fungi he studied, whether new or previously described, frequently correcting earlier descriptions or adding detail missing from them.

From 1891 to 1911, Victorian fruit exports expanded by 1,000%, partly because of a dramatic expansion of horticulture, because of improving access to off-season overseas markets, and improved fruit quality because of better pest and disease control. McAlpine's early success in winning grower confidence added to his workload. Initially McAlpine worked from a laboratory

in his own home in suburban Armadale, set up at his own expense. In 1900, recognising the increasing importance of McAlpine's role, the Government provided him with an able assistant, Mr. G.H. Robinson. In 1904, McAlpine received 1,179 specimens sent from every state in Australia for diagnosis and advice. He examined each and responded to every one in long hand! In 1906 the Government provide him with a six-room facility in the city. In 1908 Charles Brittlebank replaced G.H. Robinson and the pace continued. During 1908,1909 and 1910 McAlpine processed 858, 921 and 916 specimens respectively, while coping with increasing calls on his time to deal with escalating concern over bitter pit in pome fruits, Irish blight of potatoes, writing a book on potato diseases and providing lectures at the pharmacy college and other venues.



The first plant pathology laboratory in Australia was located in Daniel McAlpine's home in Armadale St Armadale, Melbourne.

Between 1899 and 1911 he published 200 papers, five books, three on diseases of citrus, stone fruits and potatoes, and two monographs, one on the rusts of Australia, the other on the smuts of Australia. During this period he was also close to finishing *Handbook of Australian Plant Diseases* but sadly as the result of the harsh treatment metered out to him at the end of the bitter pit investigation, his anger overcame his will to complete it.

Bitter Pit of Pome Fruits

Soon after their appointments in New South Wales and Victoria respectively, Nathaniel Cobb and Daniel McAlpine were aware of growing concern among orchardists about a disease of pome fruits Cobb had named "bitter pit". By 1909, it was a serious national problem. It halved Australian apple harvests in years of high incidence. By 1911, a nationwide investigation was set up and run from the Prime Minister's office. Although reluctant to head the investigation, McAlpine accepted after the Victorian Minister for Agriculture, Hon. George Graham, promised to reinstate him as Vegetable Pathologist at its conclusion. The offer of a salary of £1,000 per annum, over 20% greater than the British Prime Minister was paid, was no doubt also persuasive! The investigation was administered by The Commonwealth Advisory Committee on Bitter Pit consisting of three representatives of the Commonwealth and one each from the six states. Each State Minister of Agriculture provided support needed by McAlpine to run trials and experiments in his state. Under his terms of reference he was required to identify the cause of bitter pit and find a cure for it. He also had to submit an annual report to the Advisory Committee, which, after reviewing the report and discussing it with him, sent its own report to the Prime Minister who forwarded it to each State Premier. McAlpine was required to forgo all his other commitments during the investigation, set at four years with an option of a fifth.

Prior to the investigation, McAlpine recognised that bitter pit was a physiological disorder.

Contrary to his usual procedure, he placed his emphasis in finding practices that reduced the problem rather than first attempting to identify the cause which he considered complex, its elucidation potentially time consuming and uncertain. He saw the best use of his limited time was testing practices believe to reduce the problem. He sought information from leading orchardists and horticultural officers on orchard practices claimed to reduce the incidence of bitter pit and set up trials in every state to test them. He established crossbreeding experiments, evaluated scion-rootstock combinations, studied tolerance of apples to cold temperature storage, and the amount of water individual apples transpired from petal drop to maturity.

By the end of 1915 he recommended five changes to orchard practices, which reduced the incidence of bitter pit. These were: (i) Avoidance of nitrogen-rich fertilisers [they promoted vegetative growth at the expense of fruit development]; (ii) Avoidance of heavy pruning [light pruning promoted heavier crops of moderately sized apples, less prone to pit than small crops of large apples]; (iii) Ensuring adequate and as uniform a supply of water as possible [over-watering promoted vegetative growth at the expense of fruit development, while water stress resulted in shoots drawing water and minerals from fruit]; (iv) Advised picking only mature fruit [it was less prone to developing bitter pit in store than immature fruit]; and, (v) Advised placing fruit in cool store as soon as it was picked, and retaining it in cool store until marketed. These were embraced by orchardists the world over with great satisfaction.

McAlpine observed that under dry conditions fruit failed to compete with shoots for water, initiating the death of cells around vein endings under the skin. He was confused however, by the fact that both over-watering and water stress resulted in bitter pit. This caused him to oscillate between two opposing theories on the cause. One that water stress resulted in the withdrawal of water from parenchyma cells near vein ending causing their death, the other that over-watering caused an increase in water pressure in cells at vein endings causing them to burst. At the time, knowledge of the importance of mineral balances was limited and there was no knowledge of calcium being an essential plant nutrient.

Bitter pit develops when the supply of calcium to fruit is limited. This occurs when soil calcium is deficient or when nutrient imbalances such as high soil nitrogen or potassium limit calcium uptake or availability to fruit. The significance of limited calcium as a cause of bitter pit was unknown before 1956. Today there are seven basic recommendations for control (Snowden 1990), and these include the five recommendations laid down by McAlpine in 1915, plus controlled atmosphere with cool storage, and calcium sprays and amendments. While fruit growers around the world benefited from and lauded McAlpine's success, his political masters deemed him to have failed in not finding the cause of bitter pit, and excluded him from further involvement in continuing state-based investigations.

The Eclipse of a Brilliant Reputation

Professor Alfred Ewart was jointly Professor of Botany at Melbourne University and Victorian Government Botanist from 1906. Throughout the bitter pit investigation he harassed McAlpine. Ewart was angry because he considered a "university man", should have led the investigation and he implemented a range of strategies aimed at undermining McAlpine's reputation. He inferred that McAlpine was incapable of fulfilling his terms of reference and continuously referred to him as a man of only technical ability. Ewart was strongly disapproving of a man who held no degrees having been appointed ahead of him, when he held two PhD degrees plus a D.Sc.

Ewart attempted to stop or delay the investigation by claiming his research fellow, Dr. Jean White, had found that lead arsenate, used to control codling moth, caused bitter pit. This proved untrue, but threatened to delay the start of the investigation for a year. When Government tests

found no evidence to support White's hypothesis, the delay was only a few months. In spite of evidence never being produced to support the poison hypothesis, Ewart persisted with it. After the investigation began, Ewart accused McAlpine of plagiarising a paper published in 1682. McAlpine would have ignored it but when Ewart also primed two senior members of the Advisory Committee to support the accusation, McAlpine took it up with his Minister. This resulted in the Chairman of the Committee being replaced and McAlpine's relationship with the Committee being undermined. Sadly, Ewart's malicious campaign against McAlpine ended his career, but his recommendations are still valid (Snowdon 1990, Dart 2004).

From the end of 1916, McAlpine was isolated. Minister Graham had retired and his promise to reappointment McAlpine was not honoured. McAlpine's applications for support to continue breeding and rootstock/scion experiments, which he began in 1912 and were just beginning to bear, were unsuccessful, further frustrating him. In 1917 he gave up and retired to his farm, *Invercliffe*, at South Wandin, angry and bitterly disappointed. His brilliance was overshadowed by perceptions of failure.

His heart was not in farming. He maintained a wide correspondence with friends and colleagues and wrote an Esperanto dictionary, which was received by the League of Nations. Eventually he and Isabella sold the farm, having been invited to live with and enjoy the company of their four daughters and their families. He died in Leitchville on 12th October 1932 and was buried in the Cohuna cemetery.

Following his death, there was no mention of him in the scientific press except the *Australian Journal of Pharmacy* (Anon 1932a) and *SUAGA* (Anon 1932b), the organ of the Sydney University Agriculture Graduates Association, the latter noting the deaths of Daniel McAlpine and Nathaniel Cobb and paying tribute to the great legacies they left. Tributes from past students and staff of the Victorian College of Pharmacy, and those sent from friends and colleagues overseas, however, were glowing in their praise of his legacy, friendship and charm, and of their experiences during the McAlpine years.

Over the 60 years following his retirement, public memory of this great man faded but was never extinguished because of the efforts of the few who knew his worth. The year after McAlpine's withdrawal from public life, Professor H.H. Whetzel (1918) claimed Daniel McAlpine and Harry Marshall Ward were the two great British plant pathologists of the late 19th and early 20th centuries. In 1923, overseas visitors at a Pan-Pacific Science Conference held in Melbourne, Dr. T.M. Enfield and Dr. E.J. Butler, moved *that the meeting record its feelings of regret that Mr. D. McAlpine had not been present at the conference; and express its deep appreciation of the value of his contribution to plant pathology and trusted that he would long be spared to take an interest in the Science which owed so much to his pioneering investigations.*

In 1949, Mr. Stan Fish and Dr. Charles McGee, Chief Biologists respectively of Victoria and NSW, attempted, unsuccessfully, to have a special centenary postage stamp issued to commemorate McAlpine's birth, as was done for William Farrer four years earlier. Following the establishment of the APPS in 1969, Fish (1976) published a brief biography of McAlpine. After the Society took over the running of its own conferences from CSIRO in 1974, it decided that each of its biennial conferences should include a Daniel McAlpine memorial lecture presented by an eminent plant pathologist, the first of which was presented by Dr. Lilian Frazer at the 1976 conference and 18 have followed at successive conferences. Thus the light again began to shine upon his brilliance.

His standing has been recognised in various ways.

A Member of the International Phytopathological Committee, which launched *Zeitschrift für Pflanzenkrankheiten* (The first Journal of Plant Pathology) in 1891.

An Honorary Member of the prestigious German Caesarean Leopold-Caroline Academy of Natural Phenomena, 1894.

A Corresponding Member of the NSW Linnean Society from 1902.

One of the two most important British Plant Pathologists 1890-1911 (Whetzel, 1918).

A Foreign Member of the Swedish Academy of Agriculture, 1919.

The biennial Daniel McAlpine Memorial Lecture, 1976.

Daniel McAlpine Science Award for outstanding achievements in agricultural science, 1992.

The Daniel McAlpine Medal sponsored by the International Mycological Association to encourage eminent young mycologists, 2010.

Further Reading and References

Anon. (1932a) Death of Daniel McAlpine. *The Australasian Journal of Pharmacy* October, p 99, November pp 1003 - 1005.

Anon. (1932b) The late Daniel McAlpine and Nathaniel Cobb: the passing of two pioneer plant pathologists. *SUAGA* 4 (3):15-16.

Dart, J.A. (2004) Bitter Pit in Apples. *Agfacts H4.AC.1*, Second edition, NSW Department of Primary Industries.

Fish, S. (1976) Daniel McAlpine - A Pioneer Plant Pathologist in Australia. *Australian Plant Pathology Newsletter* 5(1): 11-14.

Large, E.C. (1940) *The Advance of the Fungi*. Jonathan Cape, London. 488 pp.

McAlpine, D. (1910a) *Twenty Years of Plant Pathology in Australia*. Report of the Vegetable Pathologist for 1907 - 1910, pp 56 -61. Department of Agriculture, Victoria.

McAlpine, D. (1910b) The Romance of Plant Pathology. *Victorian Naturalist* 27: 127-129.

McAlpine, D. (1922) Prevention of loss in oversea apple shipments. *Fruit World of Australia*, October 2nd, pp 334-337. [note his use of "oversea", which was usual]

Parbery, D.G. (2015) *Daniel McAlpine and the Bitter Pit*. Springer International Publishing, Switzerland ISBN 978-3-319-09551-6, 252 pp.

Snowdon, A.L. (1990) A Colour Atlas of Post Harvest Diseases and Disorders of Fruits and Vegetables, Volume 1 – General Introduction and Fruits. ISBN 7234 0931 5, Wolfe Scientific Ltd, 302 pp.

Walters, S.M. (1989) Introduction to the Bracken Books Republication of *The Botanical Atlas*, a

Guide to the Practical Study of Plants (Part 1 and 2 Combined) by Daniel McAlpine, Best Seller Publications Ltd., Princess House, 50 Eastcastle Street, London. 136 pp, ISBN 1 85170 255 5.

Waterhouse, L.W. (1939) *Proceedings of ANZAAS Conference, Canberra* **24**:234-259.

Whetzel, H.H. (1918) *An Outline of the History of Plant Pathology*, with 22 portraits. W.D. Saunders Coy Philadelphia/London, 130 pp.

Willis, J.H. (1949) Daniel McAlpine; in *Botanical Pioneers in Victoria, Victorian Naturalist* **66**: 83-89.

White, N.H. (1986) McAlpine, Daniel (1849–1932). *Australian Dictionary of Biography* **10**: 193-194, Melbourne University Press.

D.G. Parbery (15th April 2015)