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Published in:
International Journal of Epidemiology

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The French paradox and other ecological fallacies

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The Ecological Fallacy and the complexity of the appropriate weightings to apply for aggregated vs individual data, has recently been subjected to scrutiny in this journal. In 1981, three Frenchmen, Ducimetière, Cambien and Richard, coined the term The French Paradox, after having compared levels of heart disease with fat intake data provided by The Organisation for Economic Cooperation and Development. Consumption of animal fat in France was high despite the fact that mortality data showed age-standardized male mortality rates (35–64 years of age) lying just above Greece and Japan. In fact, the classic risk factors did not explain the 4-fold gradient in ischaemic heart disease later observed between Toulouse and Belfast. Ecological Fallacies typically arise when disease differences identified between countries are assumed to be caused by factors that are found to also differ—in reality the differences may be due to unknown factors. The French Paradox is an unusual example in that it compares the large differences in ischaemic heart disease between France and other countries, finds that major risk factors do not differ, and infers that the differences must be caused by unknown factors. In any case, the comparison of heart disease between France and elsewhere is far from new.

A difference in the prevalence of angina pectoris between Ireland and France had been noted by Samuel Black as early as 1819. It was William Heberden who coined the term Angina Pectoris, thereby drawing attention to the condition, in 1768. Black was born in 1763–64 near Dromore, County Down, attended Edinburgh University from 1782 to 1786, and graduated with an MD. He entered practice in Newry, County Down in 1788 and published the first of four cases of angina pectoris in 1795; he died in 1832. In his book Clinical and Pathological Reports published in Newry in 1819 it appeared to him ‘that the Physician who ascertains half a dozen of important facts, performs a more valuable, though less splendid achievement, than he who invents a dazzling theory’. Yet, Black did truly help develop a dazzling theory—the ischaemic hypothesis of angina pectoris.

A most remarkable feature of Black’s work was that he adopted an epidemiological stance in asking how individuals with angina pectoris differed from those without it. He put it more eloquently: ‘Is our knowledge of the remote causes of this disease such as to enable us to classify the liable and the exempt?’ He feared not, but continued:

...when we cannot arrive at truth in its perfect and satisfactory form, let us at least endeavour to make approximations towards it. I imagine the persons peculiarly liable are those who are of full and plethoric habits who live luxuriously, or at least very plentifully, and do not use a sufficient quantity of exercise. If there be, on the other hand, any persons possessing an exemption from the disease, total or partial, I think we shall be most likely to find them among the poor, the laborious, those who use strong exercise, the foot-soldier and the female sex....

Heberden noted the disease’s rarity in women (one), in contrast to males: ‘at least twenty...almost all over fifty years old, and most of them with a short neck, and inclining to be fat’. He had only ‘heard one or two young men complaining of it in a slight degree’. Black listed other risk factors, and, after reading Corvisart’s book on heart disease, included not
being French (or being English speaking as John Pemberton was later to observe):

Yet, in this work...there is not one word of the disease I have been endeavouring to explain and illustrate. In what light then are we to consider this fact? Can we presume that the author has altogether overlooked or neglected a disease of the heart so serious and important as that under consideration? I can scarcely admit of such a supposition. Shall we then allege that the disease is less known and of less frequent occurrence among our neighbours, than among the inhabitants of these islands? That, I think, is sufficiently probable. I can readily conceive that French habits and modes of living, coinciding with the benignity of their climate and the peculiar character of their moral affections, may have a less tendency to favour this peculiar disorganization than the same circumstances, considered in their application to the inhabitants of the British islands. It is not to be imagined that a disease of the heart, attended with such marked lesion of structure, should be altogether omitted in a work of this kind, if it were of frequent occurrence.

Black suggested some possible new Fallacies: lifestyle, better climate (Vitamin D?) and psychological stress (‘moral affections’—a literal translation of Corvisart’s ‘affections morales’).

In 1816 Black moved to Dublin, where access to the College of Physicians’ library would have been helpful for his book. In it he included his four cases of angina pectoris, adding notes and comments. Although the cases are fairly well referenced, the other material is less well so and it is unclear as to the sources of some of his ideas. In his first case, Black referred to one published in Medical and Philosophical Commentaries in London in 1777. It was taken from David Macbride’s A Methodical Introduction to the Theory and Practice of Medicine, which had been published in Dublin that year in two volumes.

Macbride (Figure 1), the son of a Presbyterian clergyman, was born in Ballymoney, County Antrim, in 1726. He was educated in Ballymoney, and afterwards was apprenticed to a local surgeon. He joined the Royal Navy where he served as mate on a hospital ship, and developed an interest in scurvy, recommending lime juice as a remedy. He attained the rank of Surgeon before retiring from service in 1748. He then studied Anatomy under Munro in Edinburgh and proceeded to Leyden, and then to London to study midwifery under Hunter and Smellie. He returned to Ballymoney in 1749 but moved to Dublin in 1751, where he became very successful, and is said to have delivered the future Duke of Wellington. He was a member of the Dublin and Medico-

Figure 1 David Macbride from an engraving by J. T. Smith of a picture by ‘Reynolds late of Dublin’. Source: Smith

Philosophical Societies and a founder of the Meath Hospital.

Macbride was a man of diverse interests: he discovered an improved method of manufacturing gunpowder, a process for tanning leather for which he was awarded a gold medal by the Society of Arts, and published several Experimental Essays. These covered diverse subjects: his work on ‘Fixed Air’ (carbon dioxide) established his reputation across Europe; and that on putrefaction and antiseptics laid the groundwork for sanitary reform in France. The first edition of Macbride’s book, which concerned ‘physic’ rather than ‘medicine’, was published in London in 1772. A computer search for the first edition locates it in nearly 50 libraries. In it there was no mention of angina pectoris, which is hardly surprising since Heberden did not publish his description until 1772. Macbride died in late 1778, at just 52 years of age.

In his section on angina pectoris, which he classified under Asthmatic Diseases, Macbride included a case that had been communicated to him by Dr Smyth of Dublin, who had been ‘at the head of his profession... for near thirty years’. Edward Smyth was born in 1709, and was the 10th son of the Bishop of Limerick. He obtained a BA at Trinity College,
Dublin in 1727, an MD from Leyden in 1729 and a Fellowship from the College of Physicians of Ireland in 1738, becoming its President in 1747 (Figure 2). He predeceased Macbride by 6 weeks.

By 1770, Dr Smyth had seen only ‘eight or ten of these frightful cases before’ adding, ‘They were men between forty and fifty years of age, and of a make somewhat fleshy.’\textsuperscript{15,16} Although the case from the second edition of Macbride’s book\textsuperscript{16} is reproduced\textsuperscript{15} in Medical and Philosophical Commentaries, with an additional one, ‘brought on by a very sedentary life, and a great vexation of mind’, a remarkable commentary is omitted; perhaps the Editor dismissed it as idle conjecture. In concluding the section on angina pectoris Macbride observed, ‘The angina pectoris occurs but seldom in this country.’ He continued:\textsuperscript{16}

Perhaps we may account for this exemption, from the difference in the general course of living. In Ireland, the lower sort of may be said to live almost entirely on a vegetable diet; and they much oftener indulge in drinking spirits, than ale, or beer; whereas in England, men of all degrees, eat plentifully of animal food, and drink freely of malt liquors; and there, even many of the better rank, use these in preference to wine, or punch; while with us, every body, in anything like easy circumstances, uses wine or punch; and, in general, we are not very prone to excess in the article of gross eating; hence it is, that we much seldom see morbid degrees of obesity, than they do in England. Another circumstance may also contribute to render the disease in question more frequent there, than here; and that is, the disproportionate number of sedentary people: in England, and more especially in London, there are at least fifty persons occupied in different branches of the finer mechanic arts, and as clerks confined to a writing desk, for one that is so employed in Ireland; and the posture in which these people are constrained to sit, must necessarily tend to favour the accumulation of fat in the thorax, and so impede the circulation there; whence not only the heart and its appendages may be disposed to run into a morbid state, but the blood also acquire[s] different degrees of an acrimonious disposition.

Heberden in 1768 had only seen a little over twice the number of cases of angina pectoris as Smyth in 1777. Admittedly the numbers were small, but, by 1782, Heberden had seen over 100 cases.\textsuperscript{8} It is most unlikely that Samuel Black was unaware of the second edition of Macbride’s book\textsuperscript{16} yet he did not mention it.\textsuperscript{9} It is rare: there are four copies in Dublin (two in The College of Physicians), one in the British Library (incomplete) and three in the USA. There are too many similarities between Macbride’s long paragraph above and Black’s conclusions. For a start, although ‘the immortal Cullen’, as Black referred\textsuperscript{9} to him, often used ‘liable’ in his First Lines of the Practice of Physic, published\textsuperscript{23} in 1774, there was no mention of ‘exempt’. Macbride employed ‘exemption’ above, as did Black elsewhere in his book.\textsuperscript{9} William Buchan in his Domestic Medicine,\textsuperscript{24} published originally in 1769, employs both words, but, although this is a fine distinction, in relation to parts of the body rather than the individual.

Macbride made an inter-country comparison of angina pectoris prevalence and came up with the possible Fallacies of greater wine and punch consumption, less obesity and more exercise and a less ‘acrimonious disposition of the blood’ (homocyst-eine?) as an explanation of why the Irish were ‘exempt’. He even suggested that faulty posture favoured the accumulation of fat in the thorax. Samuel Black listed ‘Those with an accumulation of fat around the heart’, as a ‘liable’ factor.\textsuperscript{9}

Perhaps because of his strong Presbyterian background, Black had no time for alcoholic beverages. He was ‘inclined to propose a regimen of the most abstemious kind, exclusive, in a great measure, of animal food and all fermented drink’.\textsuperscript{9} Thus when he noticed the even greater heart disease gradient between Ireland and France than between England and Ireland, he adopted Macbride’s methodology but jetisoned Macbride’s prime candidate to account for the difference—wine (and punch) consumption. This has

\textbf{Figure 2} Edward Smyth from an engraving, after a portrait by Rupert Barber. Courtesy of The Royal College of Physicians of Ireland
been the most seductive hypothesis, re-erected25 after two centuries, to explain The French Paradox. Now there are some reasonable prospective data to support it.26

It seems that The French Paradox began life as The Irish Paradox, but Samuel Black deserves full credit for his original observation. Macbride’s observations on the other hand were inspirational, and must have been considerably influenced by Edward Smyth. Perhaps if Macbride and Smyth had not died so soon after the book’s publication, and if it had commanded a wider audience, their observations might have received the attention they so richly deserved.

Acknowledgements
I wish to thank Robert Mills and Mary O’Doherty, Librarians, The Royal College of Physicians and The Royal College of Surgeons of Ireland, respectively. I am indebted to Deva Evans for her assistance with the figures. Special thanks are due to François Cambien of INSERM, Paris, for his advice and friendship over many years.

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