

Treasure (2017). Turning blue babies pink: Alfred Blalock's shunt for Fallot's Tetralogy.

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The Johns Hopkins' and Guy's hospitals exchange programme

In 1946 a programme of exchanging clinical teachers was established between Guy's Hospital in London and Johns Hopkins Hospital, Baltimore. The idea had arisen during World War 2 while Rowan Boland, who returned to be dean of the medical school at Guy's, was serving alongside American military doctors with the allied forces' medical services in North Africa and the Mediterranean. He wrote to Dr Alan Chesney, his counterpart at Johns Hopkins Hospital, that the 'object of the exchange would be to maintain the friendship, cooperation and exchange of ideas which has been one of the better things which have come out of this War'. The proposal was accepted on both sides and it was decided that Dr Alfred Blalock would be the first to come to Guy's (Treasure 2017).

Blalock (Fig 1) had by then already achieved remarkable success in dramatically improving the lives of 'blue babies' by operation (Blalock and Taussig 1945). The most common underlying cause was Fallot's Tetralogy. The two key components of the constellation of anatomical features are a ventricular septal defect and restriction of the outflow from the right ventricle. This obstruction forces most of the deoxygenated blood to pass through the septal defect, bypass the lungs, and be pumped into the systemic circulation. This results in unremitting cyanosis. The text book edited by Conybeare, Guy's senior physician, taught that cyanosis 'is so characteristic that "blue baby" and congenital heart disease are practically synonymous' (Conybeare 1946). Any exertion, crying or feeding increased the oxygen demand and with even less oxygen being delivered to the brain, these children could sporadically lapse into unconsciousness. Furthermore, the teaching was that there was little or nothing which could be done to help (Campbell 1946).

Guy's welcome to Alfred Blalock

Alfred Blalock arrived at Guy's for a month's stay in September 1947. Dr Maurice Campbell had been seeking out suitable cases for Blalock to operate on (Campbell 1947). Mr Hedley Atkins, the director of surgery, arranged for beds and operating time to be available (Treasure 2017). During his stay, Blalock operated on 10 children. He performed an operation in which the subclavian artery was mobilised and anastomosed end to side into the pulmonary artery. (Fig.2). Within moments of the vascular clamp being removed from the subclavian artery the oxygen saturation of the blood rose and the cyanosis lessened markedly. In a lecture to Guy's students in October 1947, about six weeks later, Dr Campbell said: '...a few words about the actual results in these cases. Many of you have seen them in the wards and observed the improvement while they were there. Last week I saw the first three back at the hospital for

the first time since they had been discharged. I was almost alarmed at the amount they were doing. ... I did not appreciate how much a child, suddenly relieved of his lifelong disability might want to do. ... One of them who had rarely walked more than about 10 yards is now running about all day; the parents say it is very difficult to stop him doing anything' (Campbell 1947).

Observation of dramatic association as evidence of causality

The contemporary eye witness account (Campbell 1947) and the published results (Campbell 1948; Baker et al. 1949) indicate that the paper announcing the first three operations published in 1945 by Alfred Blalock and Helen Taussig ([Blalock and Taussig 1945](#)) merits a place in the James Lind Library as an instance in which a change in symptoms could be reliably attributed to the intervention on the basis of before and after observation alone. It meets all of the criteria suggested by Glasziou and his colleagues ([Glasziou et al. 2007](#)). The beneficial effect was immediately evident ([Fig.3](#)), the changed physiology had a clear mechanistic relationship to the intervention, and the difference in the clinical state of the child was large and sustained.

It is also noteworthy that the results of the operation were consistent and could be replicated: Blalock went on to Paris to do more operations before returning home. While he was in London it was arranged that he would give the Moynihan lecture at the Royal College of Surgeons on his experience in 610 cases (Blalock and Bahnson 1948). The subclavian flow was usually about right to substantially improve oxygenation but not to harm the pulmonary vasculature. Also there was uncertainty as to whether the continuing presence of the ventricular septal defect would nullify any benefit from the shunt. Neither was predictable; fortune favoured the brave. It was not possible to complete the physiological correction by closing the septal defect until the mid-1950s at the Mayo Clinic (Kirklin et al. 1955; 1956) and a few years later in London.

Blalock and Taussig were prominent speakers at the International Conference of Physicians meeting held at the Royal College of Physicians 8-13 September 1947. Theirs and other contributions to surgery of congenital heart disease by Crafoord and Tubbs were reported in the next issue of the BMJ (Taussig et al. 1947a) and the Lancet (Taussig et al. 1947b) on 20th September and written up in full in the *British Heart Journal* (Taussig et al. 1948).

The Johns Hopkins team

As a paediatrician at Johns Hopkins Hospital, Helen Taussig had made the astute clinical observation that among children with Fallot's Tetralogy those in whom the ductus arteriosus remained open seemed to have better exercise tolerance. The operation was probably her brain child and there were no doubt others who deserved credit. In Alfred Blalock's animal laboratory, however, there was a black technician, Vivian Thomas, who should rightly have a mention here. Working on janitor's pay he did the experimental surgery for Blalock. It was Thomas who successfully made the systemic to pulmonary shunt in the laboratory. At a time in Baltimore when black workers came and went through the back door of the hospital, for the first operations on patients, Blalock had Thomas stand close in behind him at the operating table, against all convention, so that he could quietly give words of advice and encouragement to his chief. However, it was Hank and Mrs Bahnson, not Vivian Thomas, that the Blalocks

brought with them to London (Treasure 2017). It was only years later, in 1976, that the contributions of Vivien Thomas were formally recognised with an honorary doctorate from Johns Hopkins.

Johns Hopkins' choice of Blalock to be the first exchange visitor was a fortunate choice for Guy's. Russell Brock was one of the surgeons there who had developed thoracic surgery as a specialty in the 1930s and he was poised to begin operating on the heart. Operations for coarctation of the aorta and persistent ductus arteriosus were already in the repertoire and from 1947 he continued and extended surgery on Fallot's Tetralogy (Treasure 2017). The Guy's team wrote up the clinical details and results in the first 17 patients in 1948 (Campbell 1948) and by January 1949 an account of their first 50 operations for *morbus caeruleus* were ready for publication in the *British Heart Journal* (Baker et al. 1949). They reported 200 Blalock operations in the *British Medical Journal* in 1953 (Campbell and Deuchar 1953).

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The Peacock Club

Brock wanted to not only palliate cyanosis by an operation *adjacent* to the heart but he wanted to operate, *within* the heart, to relieve stenosis. His use of the word 'intracardiac' was quite deliberate. Speaking at the Royal Society of Medicine in April 1951 he explained his strategy:

Intracardiac surgery is not for the lone worker. Team work is essential. To give one example, at Guy's there is a group of some 15 people actively engaged in the work, and as time passes we find that more and more are drawn into the team (Brock 1951).

This group was the Peacock Club (Treasure 2017). Brock convened a meeting to bring cardiology, radiology, clinical science, anaesthesia and surgery into close team work in April 1948 (Fig.4). This was the first of a series of 47 consecutive, minuted meetings of the Peacock Club from then until 1956. An important contribution made by the club was in the surgery of mitral stenosis (Treasure 2016). A full account of the Peacock Club is published as a book, including full transcripts of the meetings with annotations and biographical information about those who attended and visited (Treasure 2017). A facsimile of the minutes of the meeting of the Peacock Club is available as an [Appendix](#) to this article.

Acknowledgements

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Captions

Figure 1. Alfred Blalock. Picture from the Estate of Yousuf Karsh. The little boy was the third patient operated on by Blalock at Guy's. He was photographed by the Express and Blalock took the picture back to Baltimore and it is here seen next to him in this portrait (Treasure 2017).

Figure 2. From the Moynihan Lecture 1947 given by Alfred Blalock at the Royal College of Surgeons (Blalock and Bahnson 1948).

Figure 3. Before and after operation. Images used in the report of the first cases at Guy's, all of these after Blalock had returned to Baltimore (Campbell 1948). King's College London Archives have provided the picture from Guy's Hospital Reports.

Figure 4. The first page of the Minutes of the Peacock Club (Treasure 2017).