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EDITORIAL

Young and Free: Over 25 Years of Seminal Contributions to Complex Congenital Heart Disease From Australia & New Zealand

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Introduction

In the second year of this journal, Timothy Cartmill (Figure 1a) provided a succinct history of the development of paediatric cardiac surgery, which had benefitted greatly from the contribution of local figures like Sir Brian Barratt-Boyes [1]. By the 1970s, three of the premier units in the world for the care of complex congenital heart disease (CHD) had been established in Australia and New Zealand (ANZ): in Auckland, Sydney and Melbourne. The tradition of multidisciplinary care established by these units – between dedicated surgeons, cardiologists, radiologists and anaesthetists – pervaded the region through generations of their trainees. The 1980s and 90s saw mortality for repair of most lesions in infancy and childhood fall to 2% overall [2]. Echocardiography and prenatal ultrasound enabled foetal detection and early accurate diagnosis, and the ready availability of prostaglandin ensured survival to transfer to tertiary referral centres. Once lesions were repaired, the technological developments available in intensive care allowed effective multi-organ support for even the smallest bodies. Cartmill concluded that, ''It remains to understand the pathology more clearly, to develop the techniques . . . and to refine preoperative and postoperative care.'' [1]

Teams in Australia and New Zealand have led too many clinical and research developments in the field of congenital heart disease in the last 25 years to list comprehensively. In this editorial, we chronicle some of the most influential and innovative work from the region. These achievements have led to a better understanding of the pathology and natural history

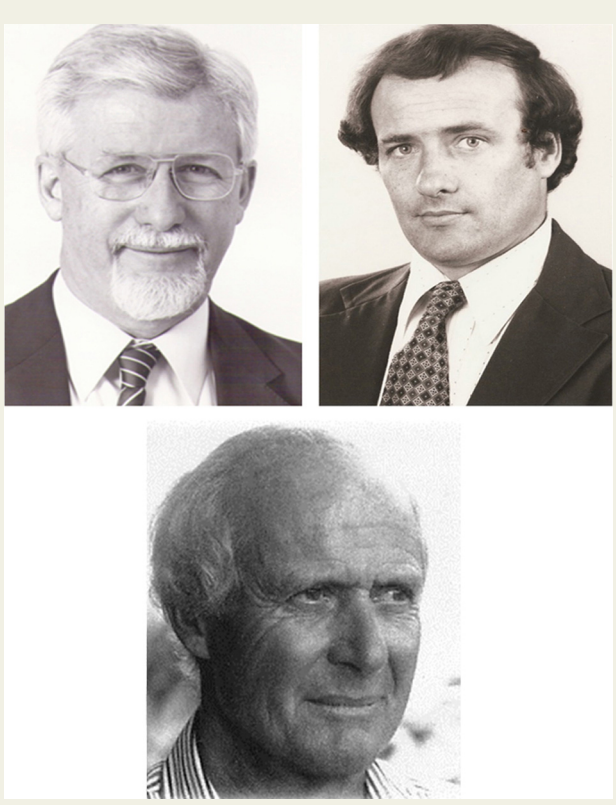

Figure 1 Legends whose legacies still shape congenital heart disease today: (a) Timothy Cartmill, (b) Roger Mee, (c) Sir Brian Barratt-Boyes.

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after repair, more sophisticated techniques and better quality of care for the most high-risk groups of patients. Our region has become renowned around the world for its multi-disciplinary and multi-institutional collaborations, which are resulting in small improvements in already excellent outcomes.

Advancing Pathological Understanding

The Causes and Inheritance of Congenital Heart Disease

Most congenital heart disease is known to develop through a complex interplay between genes and the environment [3]. Through international collaboration between basic scientists, clinicians and genetic counsellors, the team at The Children's Hospital at Westmead and the Victor Chang Research Institute in Sydney have made strides in defining the causes and inheritance of congenital heart disease. Basic science research has contributed to our understanding of normal cardiac development, and the genes involved [4–8]. The establishment of a DNA bank has enabled identification of some genes and mutations responsible for the 20% of cardiac anomalies caused primarily by genetics. Their team are now uniquely poised to take advantage of recent technological advances such as whole gene and whole exome sequencing to delineate the genetic component of the remaining 80% of congenital heart disease that appears to be sporadic [9]. The translation of this research into the genetics clinic, through the development of a gene panel, has enabled better counselling and screening of families affected by congenital heart disease [9] (Figure 2).

Understanding Natural History through Follow-up Studies

The team at the Royal Children's Hospital in Melbourne have continued the legacies of Roger Mee (Figure 1b) and Tom Karl by publishing a series of long-term follow-up studies in the last decade. Thanks to the adoption of institution-wide policies for the management of most lesions and close follow-up by a small community, the repaired natural histories of transatrial repair of Tetralogy of Fallot (675 patients), complete and partial atrioventricular septal defect (138 and 249 patients), interrupted aortic arch and coarctation (112 and 305 patients), transposition of the great arteries (618 patients) as well as neonatal and paediatric aortic valve repair (142 patients) are now clearly described [10–16]. Much controversy has been created by the description of the origins [17] and natural history [18] of unifocalised MAPCAs (82 patients) (Figure 3). Finally, the description of survival beyond infancy of patients undergoing univentricular palliation [19] is the largest of its kind (499 patients). These single-centre follow-up studies provide our community with a better understanding of the long-term expectations for repaired congenital heart disease than we had before, and have enabled identification of areas in which large efforts will be required to achieve any remaining improvements in outcome.

Improving Techniques

Nunn's Repair of Atrioventricular Septal Defect

Repair of atrioventricular septal defect (AVSD) has historically been complex and difficult to teach. In 1995, Graham Nunn described a simplified technique which allowed

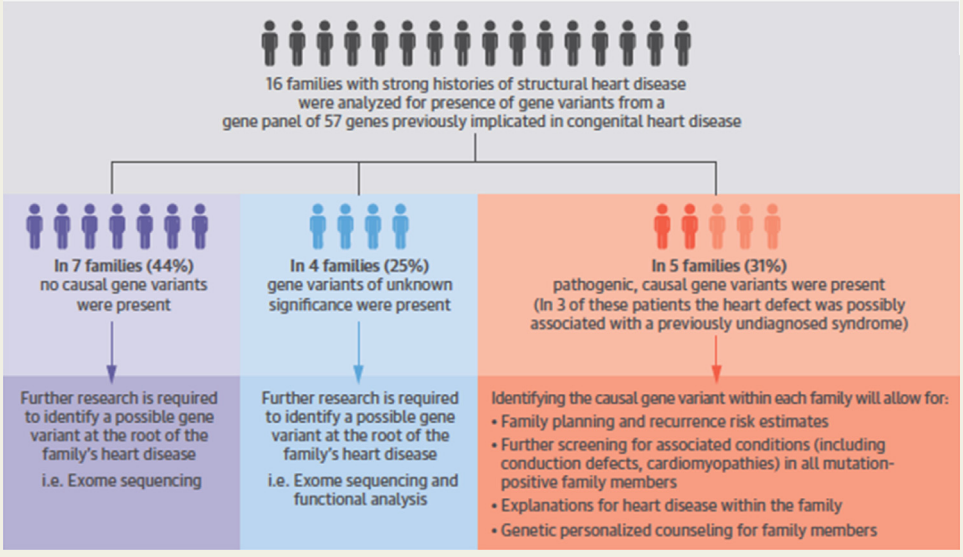

Figure 2 Next-generation sequencing has been used to identify pathogenic gene variants from a panel of 57 previously-identified genes in 31% of families tested. (Reproduced with permission from Blue GM et al. J Am Coll Cardiol 2014;64:2498-506.).