Pioneer: Robert Anderson, MD, PhD, FRCPath

Responsible for Demonstrating the Location of “Invisible” Conduction Tissues Within and Clarifying the Morphology of the Congenitally Malformed Heart

Research conducted by Robert Anderson, MD, PhD, FRCPath, retired professor of paediatric cardiac morphology, Institute of Child Health, University College London, London, England, into the anatomy and development of the normal and congenitally malformed heart has “played a large part in permitting surgeons to improve the results of paediatric cardiac surgery.”

Professor Anderson has published on virtually all congenital cardiac malformations but says, “Probably the lesion that we have done most to clarify is atrioventricular septal defect.” He is most proud of the work clarifying the morphology of the congenitally malformed heart and demonstrating within the malformed heart the location of the otherwise invisible conduction tissues. However, he looks back at his initial article on the disposition of the conduction tissues in congenitally corrected transposition as one that had the most impact on his work. He explains, “This led the way to many subsequent investigations of the location of the conduction tissues in congenitally malformed hearts and indicated the need to understand the morphology of the hearts and the normal disposition of the conduction tissues. It has now lent itself to my ongoing studies of the development of the heart and the conduction tissues.” Professor Anderson has found the mechanics of cardiac development to be the most challenging, but adds, “This is now taking shape thanks to the work I have been able to continue in my ‘retirement’.”

On other pages...

Spotlight: Georg M. Wieselthaler, MD

Georg M. Wieselthaler, MD, associate professor of surgery in the Department of Cardiothoracic Surgery at the Medical University of Vienna, Vienna, Austria, has spent more than 2 decades pioneering work on heart pumps and circulatory support. He was part of the Viennese team who in 1998 implanted 2 patients with a rotary blood pump who then became the first long-term survivors of the technology and its pulseless pattern of blood flow.
A Damascene Moment “Transformed My Career”

Born in Wellington, Shropshire, England, in April 1942, Professor Anderson was educated at the grammar school in the town from 1952 to 1960 before studying medicine, with an intercalated degree in anatomy, at the University of Manchester, England, qualifying BSc in 1963, and MB ChB in 1966. He initially intended to become an ophthalmologist, but instead returned to the Anatomy Department, where he had carried out the work for his BSc thesis, and became “consumed with cardiac anatomy.”

A chance encounter then led to a Damascene moment and the work that would prove so influential to the practice of paediatric cardiology and cardiac surgery. He says, “While I was still at an early stage, someone showed me a section from a child undergoing surgery in Liverpool [England] and sadly dying. The surgeon had put a suture around the conducting bundle between the atrial and ventricular chambers. This was my introduction to the congenitally malformed heart.” The Liverpool team made it possible for him to begin his combined studies of the congenitally malformed heart, which proved to be a largely unpopulated area. My collaboration with all my clinical colleagues made it possible to perform the crucial clinicomorphological correlations that have been the bedrock of my career.”

The support provided by Anderson’s chief, George Mitchell, OBE, FRCS, in Manchester, and the cardiac surgeon David Hamilton, FRCS, in Liverpool, led to a Medical Research Council (MRC) Travelling Fellowship at the University of Amsterdam, Amsterdam, the Netherlands, in 1973.

Professor Anderson recalls, “This initial introduction heralded the research that got me to Amsterdam, and let one thing happen after another. The experience transformed my career. With the MRC Travelling Fellowship, I came into contact with Professor Durrer [MD], who was my initial mentor. He supported me strongly in Amsterdam and made it possible for me to work with Giel Janse, MD. Needing pathological material, I was then introduced to Anton Becker [MD]. This started a collaboration that has extended throughout my career. My initial research involved the conduction tissues in the heart and also included studies of the developing heart. On the basis of this work, we rediscovered parts of the conduction tissue that had been described by German pathologists, but then forgotten. These findings proved of huge significance for paediatric cardiac surgeons. Elliot Shinebourne [MD, FRCP] heard me present this work and asked whether I would work with him as a clinical anatomist. With his support I was able to become a full-time professional clinical cardiac anatomist. This gave me the opportunity to use my anatomical skills and expertise in a clinical setting and be remunerated at clinical rates.”

With funding arranged through the Joseph Levy and British Heart Foundations, Professor Anderson accepted the role that provided the basis of his career as professor of paediatric cardiac morphology. He says it effectively “cemented the remainder” of his career, with 25 years spent at the Royal Brompton Hospital and the final 8 years at Great Ormond Street Hospital Institute of Child Health until his retirement. He says, “Throughout this period, I maintained my active collaboration with Anton Becker, and together we published articles on the morphology of most congenital cardiac malformations.”

He says, “As an anatomist, the ‘pathology’ of congenital cardiac disease was a relatively open book because it is mostly deranged anatomy. Thus, my initial training in anatomy set me up ideally to become an expert in the structure of the congenitally malformed heart, which proved to be a largely unpopulated area. My collaboration with all my clinical colleagues made it possible to perform the crucial clinicomorphological correlations that have been the bedrock of my career.”

Now in ‘retirement,’ Professor Anderson continues his research with colleagues. Since 2007, he has been emeritus professor, University College London; emeritus visiting professor, University of Manchester; professorial fellow, Institute of Human Genetics, Newcastle University, Newcastle, England; and visiting professor of paediatrics, Medical University of South Carolina, Charleston, SC, where he teaches fellows paediatric cardiology. He also retains his collaborations with colleagues at the University of Pittsburgh, Pittsburgh, Penn, and has established important new collaborations at the University of Florida, Gainesville, Fla, and the Children’s Memorial Hospital, Chicago, Ill.

“I Would Like to Be Able to Translate My Expertise in the Structure of Congenitally Malformed Hearts Into Elucidating Their Morphogenesis”

Professor Anderson was instrumental in establishing the British Congenital Cardiac Association, and was president from 1999 to 2001. He is also involved with the British Cardiovascular Society, the European Society for Cardiology, the Anatomical Society, the International Nomenclature Committee, and the World Society for Paediatric Cardiac Surgery. He is an honorary fellow of the Association for European Paediatric Cardiology and the European Association for Cardiothoracic Surgery.
Along with Bill Henry, MD, Professor Anderson founded the journal Cardiology in the Young, and was editor-in-chief until 2 years ago. He adds, “While working at the Royal Brompton, I was able to collaborate with colleagues working at Great Ormond Street and Guy’s Hospital, and this collaboration led to us produce what is now recognised as the foremost textbook in paediatric cardiology, now in its third edition.”

Professor Anderson has received several special awards including the Excerpta Medica Travelling Award (1977), the Thomas Lewis Gold Medal of British Cardiac Society (1982), the British Heart Foundation Prize for Cardiovascular Research (1984), and the James Mackenzie Lifetime Award of the British Cardiovascular Society (2007).

Within his own field of work, Professor Anderson believes the major developments will be in cardiac embryology. He says, “The developments in cardiac embryology are truly spectacular. I would like to be able to translate my expertise in the structure of congenitally malformed hearts into elucidating their morphogenesis.”

He advises young people wanting to follow a career in medicine or cardiology to “work hard and develop an excellent research portfolio.” As for his own future, his ambitions are a blend of personal and professional: “to continue research and teaching; to drink more fine wine; to maintain my golf handicap; and to improve my piano playing so as to include the chamber works of Beethoven, Schubert; and Schumann.”

Professor Anderson in Pittsburgh, Penn, 2008, with, from left to right, “my old friend” paediatric cardiologist, Bob Zuberbuhler, MD, from the Children’s Hospital of Pittsburgh, Pittsburgh, who offered him a platform for research at the University of Pittsburgh: Sang Park, MD; Victor Morell, MD; and Steve Webber, MD. A number of people inspired Professor Anderson and had a role in helping shape his career. At the University of Amsterdam, the Netherlands, these people included Dirk Durrer, MD, professor of cardiology and clinical physiology; Michiel (Giel) Janse, MD, PhD, emeritus professor of experimental cardiology; and Anton Becker, MD, professor in the Department of Cardiovascular Pathology. Other key figures included Elliot Shinebourne, MD, FRCP, consultant paediatric cardiologist at the Royal Brompton Hospital, London, England; Michael Tynan, MD, FRCP, professor in the Department of Paediatric Cardiology, Guy’s Hospital, London; the late Fergus Macartney, MB, FRCP; and Jane Somerville, MD, FRCP; initially from the National Heart Hospital and subsequently at the Royal Brompton Hospital. Professor Anderson also reflects on being inspired by meetings with John Kirklin, MD, from the University of Alabama in Birmingham, Ala; Francis Fontan, MD, from Bordeaux, France; and Lucio Parentan, MD, from Bergamo, Italy. Photograph courtesy of Professor Anderson.

References

Mark Nicholls is a freelance medical journalist.
Spotlight: Georg M. Wieselthaler, MD

Pioneering Work on Heart Pumps and Circulatory Support

Georg M. Wieselthaler, associate professor of surgery and medical director for mechanical circulatory support, Department of Cardiothoracic Surgery, Medical University of Vienna, Vienna, Austria, and vice president of the International Society for Rotary Blood Pumps talks to Jennifer Taylor, BSc, MSc, MPhil.

The introduction of rotary blood pumps ushered in a new era in the field of mechanical circulatory support, and Georg M. Wieselthaler, MD, associate professor of surgery and medical director for mechanical circulatory support in the Department of Cardiothoracic Surgery, Medical University of Vienna, Vienna, Austria, was an early investigator of this new technology. Surgeons were using pumps that produced pulsatile blood flow, and it was believed that this was needed in the long term. The new pumps produced a pathophysiological situation of nonpulsatile flow.

The race in 1998 to implant the first miniaturised axial flow pump was between Vienna and the German Heart Centre in Berlin, Germany. The pump’s inventor, Michael DeBakey, MD, of Baylor College of Medicine in Houston, Tex, asked both centres to identify patients, settle any regulatory issues, and let him know when they were ready. Professor DeBakey was therefore in Berlin when Professor Roland Hetzer, MD, PhD, medical director and chair of the Executive Management Board Deutsches Herzzentrum, Berlin, implanted the first 2 patients in the world, but neither survived. He was also present when 2 patients were subsequently implanted in Vienna in 1998 by Professor Ernst Wolner, Professor George Noon, and Professor Wieselthaler, and these patients became the first 2 long-term survivors of the new technology and its consequent pulseless pattern of blood flow.

Both patients survived and were transplanted, though 1 has since died of cancer. Photograph courtesy of Professor Wieselthaler.

Professor Wieselthaler’s experience operating on animals and as an electrical engineer meant that he was well suited for the heart pump field. His father was a veterinarian, and as a boy, he helped his father operate on domestic pets, as well as boa constrictors, pythons, and crocodiles from a nearby snake farm. Here he assists his father in an operation on a 6-metre long python. After graduating in electrical engineering in 1978 Professor Wieselthaler was uninspired by his first job, so he decided to pursue medicine instead, graduating from the University of Vienna in 1987. Photograph courtesy of Professor Wieselthaler.
physical rehabilitation training and spiroergometry of patients with the pump. The award is named after veterinarian Donald Olsen, a major mentor of the mechanical circulatory support community and an early collaborator of Willem Kolff, MD, and Robert Jarvik, MD. He participated in the first long-term total artificial heart implantation in Dr Barney Clark in 1982 in Salt Lake City, Utah.

Professor Wieselthaler’s studies with his colleagues on the hormonal regulation of patients on long-term nonpulsatile support showed that endocrine function was not impaired compared with age- and sex-matched controls, and they also confirmed that nonpulsatile flow is not deleterious in the long term. Today they know that the flow is not completely nonpulsatile; rather it is a low pulsatile flow with a low-pulse pressure amplitude, and some of their patients have been supported for up to 8 years on these pumps.

**Production and Implantation of a Total Artificial Heart in 1986**

Vienna has a long tradition of using circulatory support systems, and the chair of the department, Professor Ernst Wolner, MD, was the first person to insert an intraaortic balloon pump into a human in Europe in 1968. During medical school, a programme on the total artificial heart was relaunched, and Professor Wieselthaler was given a job as a calf sitter in the animal lab of the surgery department in 1984. Pumps were implanted into calves, and the calf sitters were doctors for the animals and took care of the machines. It was then that the department discovered that Wieselthaler not only had experience with animals but was also an electrical engineer.

Professor Wieselthaler then moved to the engineering lab, where he met his long-term collaborator, Professor Heinrich Schima, PhD, an engineer. Together they worked on the driving unit of the total artificial heart. He says, “In those days, we believed that if you had a patient with end-stage heart failure, you had to cut out the failing heart and replace it with a total artificial heart, both ventricles, both sides, and that was the solution.”

The first implant of the total artificial heart they developed was carried out in Vienna in June 1986. It was a bridging procedure to transplantation with a donor heart, and they aimed to keep the bridging time short—between 10 and 20 days. The procedure began a series of discussions between himself and Professor Schima about how the pump could be made smaller. They concluded that there was no way to make pulsatile pumps, and especially the bulky driving units, significantly smaller, but that rotary blood pumps were an alternative that should be investigated.
that is on the market in Europe and being considered by the United States. Professor Wieselthaler began working with the Florida-based start-up company in 2003. A group of engineers had built the pump and done experiments on animals, but it needed help with clinical application. He carried out the first implant worldwide of the pump in Vienna in 2006. Both patients were supported for more than 1 year and then successfully transplanted.

Professor Wieselthaler has had a number of visiting fellowships to the United States and Canada to learn how medicine is practiced in other countries. Today he travels extensively, and he particularly enjoys collaborating with different disciplines, including engineering, haematology, and haemostaseology. One example is the collaboration with the Department of Haematology and Haemostaseology at the Medical University, Munich, Germany, to investigate the interaction of blood components with mechanical pumps that leads to anticoagulation and anti-aggregation.

References

Contact details for Professor Wieselthaler: Medical University of Vienna/Vienna General Hospital, Waehringer Guertel 18-20, 1-1090 Vienna, Austria. E-mail: georg.wieselthaler@meduniwien.ac.at; tel: +43 1 40400 6835; fax: +43 1 40400 6735.

Jennifer Taylor is a freelance medical journalist.

Photographs taken at the seminal 1988 meeting on heart pumps in Austria. Left, Drs Affeld, Olsen, and Nose in the seminar room. Right, Enjoying the evening entertainment. Professor Wieselthaler recalls, “This was one of the most memorable meetings I have ever had. We had great discussions sitting around the fireplace enjoying a glass of wine or a hot tea. It was very fruitful.” Photograph courtesy of Professor Wieselthaler.

A Seminal Meeting on Heart Pumps
Without the Internet, it was difficult to pull together the knowledge about nonpulsatile pumps, so the young fellows organised an international meeting on rotary blood pumps in 1988. The 3-day meeting was held at a ski resort in the Austrian mountains in early December. It was the only hotel open, and the heavy 1.5-metre snowfall meant no one could leave the building. The meeting attracted groups from across Europe and the United States, as well as the big personalities in the field, including Professor Olsen, MD, Yuki Nose, MD, PhD, and Professor Noon. The meeting changed the direction of their research dramatically, and they switched from the development of pulsatile pumps to the development of rotary blood pumps. They began working on a miniaturised centrifugal pump and got as far as long-term animal experiments until they ran out of financial support from the university.2 They were able to sell the motor of the miniaturised pump to Baylor College, and it is now being used in a pump available in Japan. The meeting was so successful that there was a follow-up meeting in 1991, also in Austria, and in 1992, the International Society for Rotary Blood Pumps was founded. Professor Wieselthaler is vice-president of the International Society for Rotary Blood Pumps and will be president in 2 years. He says, “The society arose out of the spirit that was created out of these 2 meetings we had here in Austria.”

Rotary pumps are high shear stress machines that can interfere with von Willebrand’s factor. The factor is cleaved into smaller parts that circulate in the blood so platelets can no longer be activated, leading to an artificial, acquired von Willebrand’s disease.6 One of Professor Wieselthaler’s primary goals is to be an interdisciplinary scientist and clinician. He says, “Sometimes you get great ideas to work on, or all of a sudden you get a solution for 1 of the questions you’ve had for quite some time. Therefore, I really like that kind of interdisciplinary collaboration.”

Another exciting piece of work is a collaboration with a U.S. company to develop a left ventricular assist device...
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