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Andrew J. Macnab – An innovator and pioneer in the field of Biomedical Near Infrared Spectroscopy

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Andrew Macnab (see Fig. 1) was born in Sussex (United Kingdom) in 1943 and went to school at Ardingly College. At school he was fascinated by light and its applications. This fascination continues to this day with his pioneering and innovative work on the application of near infrared light for understanding disease processes. Andrew completed a medical degree at University College Hospital (UCH), London. He was selected to be a Senior House Officer at UCH, where he was fortunate to have some of Britain's leading scientists, both physicists and clinicians, as his mentors. This included Osmund Reynolds CBE FRS and David Delpy CBE, FRS. At UCH, Andrew became acquainted with biomedical devices and their role in clinical care. He was invited to pursue doctoral research under the supervision of Leonard Strang. His research challenge was to develop a novel concept at the time, a portable pump system able to provide continuous intravenous infusion to a child whilst fully ambulant and residing at home. He successfully met this challenge and produced an innovative device which became the precursor of many of the systems that are currently used worldwide to administer intravenous fluid and drugs to patients [5]. The highly interdisciplinary research training that Andrew received at UCH was to have a lasting impact on his future career. It enabled him to earn a reputation as an innovator, inventor and educator.

Andrew moved to Canada in 1977 where he applied his interdisciplinary research background to develop medical technologies for advancing newborn intensive care and the emerging field of air medical

Fig. 1. Photographs showing Andrew Macnab at work with his colleagues. (Colors are visible in the online version of the article; http://dx.doi.org/10.3233/BSI-140096.)

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transport. He is currently, the head of the NIRS study group, Bladder Care Centre, University of British Columbia Hospital (Vancouver, Canada). Amongst his early achievements was the development of a system for monitoring patient's vital signs reliably during their care on aircraft. This included non-invasive, optical based monitoring of oxygen saturation, which is central to safe air medical transport, considered the 'the fifth vital sign' in medicine [9], and regarded by many as the greatest advance in patient monitoring since electrocardiography [3]. In 2000, Andrew was the physician on the team that won the gold medal for "Best new medical device in Canada" in recognition of groundbreaking research on the design of an innovative intra-osseous infusion device that can rapidly access the circulatory system to treat haemorrhagic shock [4]. This device has been credited with saving lives around the world, including many amongst armed forces personnel.

Andrew is undoubtedly both a pioneer and world authority in the field of Near Infrared Spectroscopy (NIRS). He made key improvements in NIRS hardware and software that made possible the application of the technique to the study of complex biomedical systems. Andrew's grasp of both basic and applied science made this possible. His work on the accuracy of fundamental algorithms played a vital role in the application of NIRS to the study of the brain and spinal cord in humans [1,7]. His work on using NIRS to non-invasively monitor cerebral oxygenation status gave new insights into managing the high-risk infant environment [2]. This was the first study to show that significant changes in brain blood volume occur in premature infants who are exposed to noxious nursery stimuli.

Andrew has been a pioneer in the use of NIRS for monitoring blood flow in different organs. For example, he applied the technique to optimise brain blood flow and oxygenation in children undergoing open heart surgery [10]. He also extended the application of NIRS to monitor blood flow in the spinal cord during surgery so that a surgeon can take necessary action in the event of a potentially damaging decrease in blood flow [8]. More recently, Andrew has focused on the application of NIRS to study the human bladder, making non-invasive physiological assessment of common and debilitating conditions possible for the first time. This is discussed in his review article published in this issue of the journal [6].

I came to know Andrew personally, over ten years ago, after I invited him to present a lecture at a spectroscopy conference I was chairing in London. He presented an exceptional lecture that was well received by the audience. He is particularly gifted in being able to communicate complex science into something a broad audience can understand. This, along with his gentle English humour makes him a sought after speaker at scientific meetings. I found Andrew to be a highly enthusiastic scientist with a warm personality. He is generous and goes out of his way to help others. At the conference in London, I requested him to be in charge of the poster prize. He agreed to do this and meticulously went through each of the posters, taking time in discussion with the young scientists and to provide them with advice. From this it was apparent that Andrew is a highly enthusiastic teacher. Throughout his career, he has been an outstanding educator, actively training and mentoring the next generation of scientists many of whom are already contributing in the field of spectroscopy and other disciplines around the world.

Andrew has always taken great interest in helping others, especially those who are most vulnerable in our society. It is therefore not surprising that many of his contributions focused on the application of spectroscopy for improving the health care of children. To give an idea of his humanitarian side, Andrew has consistently worked as a volunteer for aid projects in different parts of Africa. With funding from Grand Challenges Canada/Gates Foundation, Andrew is now developing an inexpensive and simplified version of NIRS technology which can be used to screen for early signs of bladder disease in rural African communities. It is hoped that he continues to enrich the scientific community and society in general with his high impact research.

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