Pioneers in South African Anaesthesia:

Dr Heyman Harold (Heymie) Samson, anaesthetic innovator

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Keywords: history of anaesthesia, breathing circuits, neonatal resuscitation, vaporisers

 South Afr J Anaesth Analg 2014;20(1):10-12

Figure 1: Dr Heyman Samson, MBE, MRCS, LRCP, FICS

Dr Heymie Samson (Figure 1) was born in Cape Town in 1911, matriculated at the South African College School in 1928, and studied medicine at London University. In 1938, he returned to general practice in Cape Town and married his wife, Phyllis. He volunteered for military service when war broke out in September 1939. He became the first South African to be awarded a Member of the Order of the British Empire (MBE) for gallantry in the North African Campaign. His interest in anaesthesia flourished during this period. He registered as a specialist anaesthetist in 1943, and in the same year while stationed at Voortrekkerhoogte became a founder member of the South African Society of Anaesthesiologists. After the war, he went into private practice in Johannesburg, while maintaining his academic link as an honorary member of the anaesthetic staff at the Johannesburg General Hospital until 1950. He returned to academic medicine as a part-time senior anaesthetist in the Johannesburg department in the early 1960s, a position which he held until 1980.

Dr Samson's understanding of the basic sciences that relate to anaesthesia, and his interest in anaesthetic safety, led to a particular interest in the development of paediatric resuscitators and neonatal and adult breathing systems. His practical skills, especially with the lathe, allowed him to manufacture and modify many pieces of anaesthetic equipment in his workshop at home in Johannesburg. A number of his inventions were patented in Europe and the USA.

His son Russell, now a vascular surgeon in the USA, recalls:

"While driving me to school, my father would suddenly get an idea. He would then stop the car in the traffic and start writing in his notebook. He didn't care that he had backed up traffic all the way to Saxonwold. When I was young, I was usually mortified by his actions, but as I grew older I delighted in his eccentricities" (personal communication).

A number of his inventions are discussed below.

The Samson neonatal resuscitator

Samson was probably best known for his neonatal resuscitators. The original version of the Samson neonatal resuscitator (Figure 2) was designed to resuscitate neonates up to 8.2 kg by either untrained members of the public or trained healthcare professionals.

Figure 2: The Samson neonatal resuscitator

Figure 3: Samson's "improved neonatal resuscitator"

It consisted of three components:

- A static-free, silicone rubber bulb of 290-ml volume.
- A non-return valve assembly.
- One of three sizes of a Rendell-Baker®-shaped face mask made of clear plastic.

The non-return valve assembly consisted of a plastic body and a floating disk which directed air towards the patient's lungs when the bulb was squeezed, and allowed air or oxygen-enriched air to enter through the air entry holes when the bulb was released. The body also incorporated a bleed hole that protected the lungs against volutrauma or barotrauma by allowing excess air volume and pressure to escape. The device was designed to be sterilised using detergents, chemical disinfectants, steam autoclaving or boiling water. It was marketed as the Lifemask Infant Resuscitator® by Electronic Monitors in the USA and by Blease in the UK.

In 1974, Samson introduced his "improved neonatal resuscitator" with its accordion-like bellows attached to a clear polystyrene valve assembly that fitted standard 22- or 15-mm mask connectors[1] (Figure 3). It was claimed that 3-6 l/minute flow through the oxygen attachment would enrich the mixture to 75-80%, without increasing the ventilating pressure. The resuscitator was supplied with a disposable, sterile Rendell-Baker®-shaped transparent mask and an endotracheal tube and connector. The unit was widely distributed throughout South Africa and elsewhere. It was marketed in South Africa by Keatings Pharmaceuticals Ltd. Its use declined after the introduction of the Laerdal® Silicone Resuscitator which produced a square pressure wave and improved blood gases when compared with the Samson resuscitator which produced higher peaked airway pressure.[2]

The Samson halothane vaporiser

In 1956, Samson published details of his halothane vaporiser, which with appropriately calibrated dials, could also be used with trilene or methoxyflurane.[3] It was a variable bypass vaporiser with a unique nylon "rotorfloat" that floated and rotated in the anaesthetic liquid around a spindle, through which gas was introduced into the vaporising chamber. The rotation facilitated vaporisation and the float allowed it to provide a relatively constant concentration, irrespective of the amount of liquid anaesthetic in the glass chamber. The design typified Samson's ingenuity, but was never able to challenge the Cyprane® Fluotec Vaporizers for accuracy of delivery of halothane vapour, and which rapidly became the standard of care in the UK, South Africa and elsewhere.

Valveless anaesthetic circuits incorporating scavenging

Dr Samson was acutely aware of the dangers of hypoventilation, and associated hypercapnoea and possible hypoxia. This led him to defend the use of cyclopropane as a safe anaesthetic agent, provided that hypoventilation was avoided, as it was his postulate that hypercapnoea was responsible for "cyclo-shock".[4] Realising that equipment design was a significant factor in rebreathing and resultant hypercapnoea, especially in small children and neonates, he developed a series of valveless anaesthesia breathing systems with minimal dead space and low resistance. In 1965, he designed a neonatal system with an apparatus deadspace of 1.5 ml, and incorporated a valveless adjustable vent.[5] This was further developed into a device that, together with Don Moyes, was described in 1980 as a replacement for traditional spring-loaded expiratory valves, e.g. Heidbrink®, and which could be placed on any breathing system that utilised such valves.[6] It operated on the principle of a spigot-adjustable orifice with a vacuum to promote the extraction of exhaled gas. It had the advantage of having no resistance, was simple to clean or sterilise (or was disposable), and allowed scavenging. Commercially available breathing systems that used the device were marketed in South Africa by Medishield as the Samson modification of the Jackson-Rees and Samson neonatal

circuits. Both were Mapleson D® systems, as requirements for low resistance are most acute in the paediatric group.

The Samson carbon dioxide absorber

Although superseded in anaesthesia by the circle absorber system, to-and-fro absorbers continued in use because of their portability at a time when most anaesthetists in private practice supplied and carried their own equipment. A common problem with using these devices was the channelling of gases in incompletely filled canisters when they were turned on their side, which led to inefficient carbon dioxide absorption. In 1957, Dr Samson overcame this problem by making the housing out of see-through material, and incorporating a metal spring to the screw-in end which applied pressure to soda lime granules to ensure that the latter were compacted, thereby preventing channelling.[7]

Dr Samson retired to the USA in 1982 to be near his family. His legacy lives on through the Hymie Samson Medal that the family endowed to the Colleges of Medicine of South Africa, which is awarded annually to candidates who obtain excellent results in the physics and clinical measurement section of Part I of the Fellowship Examination of the Faculty of Anaesthetists of South Africa. Dr Samson died in a pedestrian accident in Florida, USA, in 1990.

Acknowledgements

We would like to acknowledge the assistance rendered by Dr Samson's family, and in particular, the information supplied by his vascular surgeon sons, Russell and Ian Samson; and Dr Richard Llewellyn for reading and commenting on the manuscript.

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