



Resuscitation Great

Edgar Alexander Pask—a hero of resuscitation

Gary Enever

Royal Victoria Infirmary, Newcastle upon Tyne, UK

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Edgar Alexander Pask

Some older anaesthetists have heard the name “Pask”, but few know who he was or what he did. The Association of Anaesthetists of Great Britain and Ireland has an award named after him, for anaesthetic acts over and above the call of duty, but few know why. The man was a legend in his lifetime and set an example that was to have tremendous influence on future generations.

1. The early years

Edgar Alexander Pask, later often known as “Gar”, was born on the 4th of September, 1912. His father, Percy Pask, had started out as a barrow boy in Liverpool, United Kingdom, but soon progressed to be an important fruit importer.

E-mail address: g.r.enever@ncl.ac.uk.

Percy married Mary Speedie, a Manxwoman (as natives of the Isle of Man are known) and a staunch Methodist, and they had three sons. Alfred was the eldest, and became a Methodist minister. Edgar was next, born when the family had moved out of Liverpool to West Kirby in Cheshire. Their youngest son, Gordon, was born much later, in 1928, eventually becoming famous as a professor of cybernetics.

Edgar was educated at Rydal School in Colwyn Bay, and won a scholarship to Downing College, Cambridge to read natural sciences [1]. Following a double first class honours in his Tripos examinations in 1933, he progressed to The London Hospital to complete his undergraduate education, and qualified MBBCh. in 1937.

Pask spent 2 years at The London in junior hospital posts, and then in 1939 took up the appointment that was to change his life. With his impressive academic record, his scientific credentials and his experience of anaesthesia, the Nuffield Department in Oxford was the place for Pask. Professor Macintosh had been head of Britain’s only academic anaesthetic department since its inception in 1937 when Pask joined as the first assistant. He became one of a small but growing band of anaesthesia’s elite, and had only just settled in when war was declared [2].

In September 1939, the Nuffield Department was a hive of activity. It was not only providing anaesthetic services for the Oxford hospitals and generating a wide variety of research, but was also drawn into supporting the war effort. Macintosh, a First World War fighter pilot, was made a Group Captain to advise the RAF on anaesthesia. The Department began running short training courses for military service anaesthetists, which were very popular. They were particularly enjoyed when Macintosh packed them into his Bentley for picnics by the Thames. Staff joined and left, moving into the forces or on secondments. Pask was made the Mayo Fellow, and sent south to the Royal Sussex Hospital to help deal with casualties evacuated from Dunkirk. He was then finally drawn into a blue uniform, and followed his professor in the RAF.

2. The RAF years

Edgar Pask was a remarkable physiologist. Probably with Macintosh's encouragement, he was posted to the Physiological Laboratory in the RAF Research Station at Farnborough, where he was presented with a number of urgent questions to solve. RAF aircrew were exposed to terrible dangers, not only directly from their enemies, but also from the hostile environments they inhabited. Farnborough hosted a number of remarkable human experiments, many devised by Pask and his colleagues and using themselves as experimental subjects. He stated in the introduction to his MD thesis, submitted after the war, that he "had certain experience in the clinical and experimental practice of anaesthesia and believed that the methods used in such practice could usefully be employed in the solution of the problems under consideration" [3].

Four of the important problems considered were high altitude parachute descent, artificial ventilation, effectiveness of lifejackets and survival in cold water.

2.1. Parachute descent from aircraft flying at high altitude

In 1941, lease-lend from the United States presented the RAF with a number of B17 bombers, the legendary "flying fortresses". They were supposedly designed for accurate high altitude daylight bombing, but imposed incredible risks on the aircrew. They flew higher than Everest in a thin, unpressurised aluminium tube, exposed to bitter cold and severe hypoxia. Pask's job was to see what would happen to aircrew if they bailed out at such altitudes.

The first series of experiments, simulated parachute descent, was undertaken by the five young doctors posted to the laboratory at Farnborough. They were aged from 28 to 32 years, and described themselves as "in good health but not in good training". They were all heavy smokers, with Pask well known as a 60-a-day man. Sixteen experiments were undertaken, with Pask as the subject for seven of them. They were exposed to hypoxic gas mixtures in a decompression chamber, with the mixtures designed to simulate the inspired oxygen concentrations encountered while descending. The experimental notes make fascinating, as well as disturbing, reading. They describe young men being asphyxiated, and then slowly recovering. The experiments on Pask undertaken with him hanging in a parachute harness were particularly hazardous (Fig. 1).

It is interesting to note that the volunteers varied markedly in their ability to cope with hypoxia, and in their rates of recovery. It is not known whether they suffered sufficiently to have permanent damage, but the assessment of the risks resulted in portable oxygen cylinders being made available for high altitude crew, should they have needed to bail out over 20,000 feet.

The subsequent experiments involved Pask both as experimenter and subject. He used himself, as it was convenient to do so, in a number of hazardous situations. He

was anaesthetised to the point of apnoea then was the subject used to test the available methods of artificial ventilation. Finally, he was anaesthetised wearing a variety of lifejackets and placed into a swimming pool to test their efficiency. Anaesthesia was directed, and often given, by Macintosh himself. The professor commented that Pask did most of the important work for his MD thesis whilst asleep.

2.2. The efficiency of the methods of artificial respiration

Many aircrews were forced to ditch into the sea, where cold and injuries would eventually end in drowning. Even when rescued by the RAF's high speed launches, they were often in a poor state, and many collapsed. Artificial respiration, if required, was extremely difficult. The Schafer method [4,5] was used universally at the outbreak of war, but was almost impossible to apply below the cramped, jolting decks of a rescue vessel at full tilt. Medical staff were empowered to call for the launch to slow to allow resuscitation, but this exposed to whole crew to enemy action, and was not popular.

Faced with these problems in 1943, Pask went back to the original papers on artificial respiration, to find a method that was likely to be applicable. It had to be easy to apply in difficult conditions. As the majority of studies had either used conscious subjects or corpses, the efficacy of any particular method was uncertain. So, he allowed himself to be anaesthetised to the point of apnoea, was intubated and his minute volume was recorded on a smoked drum using a range of methods of artificial respiration in vogue at the time.

The following table gives the results:

Method	Position	Inspired minute volume (L)
Schafer's	Prone	3.44
Sylvester's	Supine	4.12
Eve's 45/45 smooth	Prone	5.82
Eve's 45/45 jerky	Prone	5.91
Eve's 30/30 smooth	Prone	3.54
Eve's 30/30 jerky	Prone	3.65
Eve's 45/45 smooth	Supine	3.80
Eve's 45/45 jerky	Supine	4.09
Eve's 30/30 smooth	Supine	2.17
Eve's 30/30 jerky	Supine	3.03
Oxford inflating bellows	Supine	4.12 (estimated)
Mouth to mouth	Supine	6.16 (estimated)
Oxford inflating bellows	Prone	5.50 (estimated)

At the time of the study, Pask was 31 years old, 10 stone (65 kg) in weight and a heavy smoker. Following review of the results, once awake, Pask decided that the Eve's Rocking Board method could be most easily and safely applied, and this was duly adopted by the RAF and then the Navy [6,7].

As a point of interest, Pask obtained some early curare from his friend Harold Griffith in 1945. He then persuaded Macintosh to repeat the experiments on him, and was fully paralysed for 2 h, to compare results with his earlier experiment.

**Descent No. 14. Subject - M.A.P. Gas mixture - Nitrogen/Oxygen
Posture - suspended in parachute harness.
Simulated altitude - 35,000 ft.**

This and the next descent caused certain anxiety and necessitated close attention to the subject. As a result, the clinical notes were compiled after the experiment, not during it.

Clinical Record.

The period of anxiety was more prolonged than in the "descent" from 35,000 ft., with the subject sitting, and not until the 6th minute was it certain that the "descent" could be completed.

The subject made two attempts to raise himself in the harness by pulling on the parachute risers during 1½-1½ mins. These attempts he could not remember afterwards. At 1½ mins., the subject became limp and relaxed, the head falling forward, but although it must have been merely a matter of chance, it was not thought that laryngeal or pharyngeal obstruction actually developed, though vigorous inspiratory efforts were made.

Sweating was very profuse and liquid sweat fell from the forehead and formed a noticeable pool on the floor.

Muscular twitching of the left arm was seen between 5th and 7th minutes.

The pulse was not rapid - indeed a good deal slower than in previous "descents" with this subject, but between 2nd and 6th minutes it was recorded as very feeble.

Fig. 1. The experimental record of one of Pask's "descents".

2.3. The efficiency of lifejackets

It was thought to be a good idea to prevent unconscious aircrew from drowning, should they parachute into the sea, but the lifejackets available that were used had never been investigated. It was a fact that many crew were found dead, face down, floating in their lifejackets. So again, Pask and Macintosh set to it. Anaesthetised and set adrift in a pool, a number of different jackets and suits were tested on Pask, breathing ether through a cuffed Magill tracheal tube via an extremely long co-axial circuit (Fig. 2). The experiments were both traumatic and dramatic. They were filmed, so that they could be shown to aircrew to boost morale and to show that something was being done. After each experiment, Pask was admitted to hospital to recover, and anecdotally he was not very well after each episode, which is hardly surprising. Often he sank completely, greatly increasing the risks of aspirating pool water (Fig. 3).



Fig. 2. Pask being placed into the pool by professor Macintosh and his team.

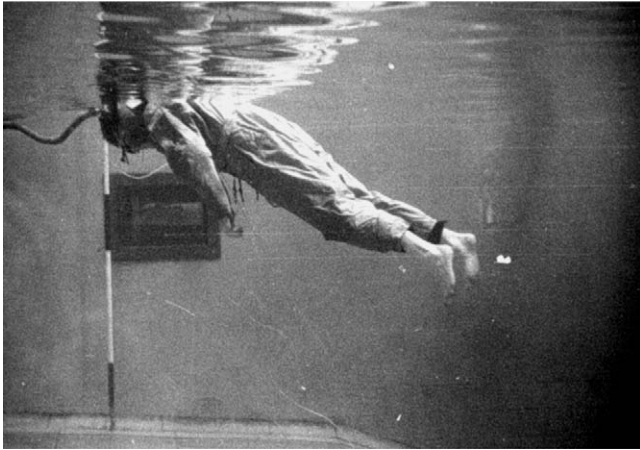


Fig. 3. Pask sinking face down below the surface of the pool.

2.4. Temperature maintenance in cold water

Aircrew ditching into the seas around Britain were likely to suffer hypothermia, and so an effective immersion suit was required. Pask experimented with a number of materials and thermal linings, to try and design a suit that was comfortable, warm and water-proof. Once created, these immersion suits were tested in typical Pask fashion. He was parachuted into the sea in winter. Pask's suits became standard issue for the RAF and Fleet Air Arm.

These extreme experiments became Pask's MD thesis, "Anaesthetic Techniques in Research", and his MD was duly awarded by the University of Cambridge in 1947. Little was known of the work, because of wartime security restrictions, and few knew that Pask had used himself as the subject. It was many years before some of the lifejacket work was published [8].

3. After the Second World War

As a non-combatant, Pask was not eligible for military medals to recognise his bravery, and was therefore presented with the OBE by King George 6th in 1944, as well as being presented with one of the first John Snow Medals by the Association of Anaesthetists. He left the RAF as a Squadron Leader, and went back to Oxford. Following the lead set by the Nuffield departments there, other universities began to establish academic departments of anaesthesia, and Pask was offered the post of Reader in Anaesthesia at King's College, Newcastle-upon Tyne (part of the University of Durham at the time). However, before taking up the post he went to Madison, Wisconsin, in the United States to learn from the "master", Ralph Waters. At the time, Pask was considering physiology as a career, but Waters persuaded him to return to the Royal Victoria Infirmary at Newcastle.

In 1947, he entered the department that was to be his home until his death in 1966. It had many similarities with Oxford, with laboratories, workshops and its own anaesthetic nurses.

Side by side with his technician, Norman Burn, he built some of the earliest British ventilators, many of which still remain in the historical collection in Newcastle [9]. Not surprisingly, after his wartime experiments, Pask was fascinated with the problems of artificial respiration. He gave many lectures on ventilation and resuscitation, in both Britain and the USA, and it is interesting to note that he emphasised the importance of blood flow and cardiac output, the use of high inspired oxygen concentrations, and the maintenance of a clear airway. He also developed some of the earliest electronic monitoring equipment used in anaesthesia.

Pask also continued his interest in lifejackets. Having become a professor (the second professor of Anaesthesia in Britain), it was not deemed appropriate for his self-experimentation to continue. A chance reading of "Popular Mechanics" magazine in 1954 informed him of the existence of the very first "test dummies", being used by the American airforce. He set off for California, and a year later "Seaworthy Sierra Sam" joined the Newcastle Department. This was the first, and possibly only, manikin designed to be water-proof, and was used extensively in a new series of experiments, which continued even after Pask's death [10].

4. Pask the man

It is clear that Pask was a quite remarkable man of phenomenal courage. Norman Burn, his technician, worshipped him. He describes a man of incredible intellect, able to understand and solve complex problems, while still able to work a lathe with great skill. Macintosh, on hearing of his death, wrote "In my opinion he was the best brain in our speciality—and I have yet to meet anyone more reliable and considerate". He was a leading figure both regionally and nationally. He lectured extensively, although it was said that he rarely spoke for more than 30 min, as by then he would need another cigarette. He was not perfect. He would shuffle past colleagues in the hospital corridor, and not acknowledge their greetings. He expected nothing but total dedication from his juniors, because his commitment was also total. They were expected to smoke, so that they would always have cigarettes and a box of matches in their pocket should the professor come by, as he persisted with his 60-a-day until his early death. Pask often appeared in theatre in the middle of the night, at the shoulder of a junior with a difficult case. His advice was invaluable, although his anaesthetic skills were not polished—he did not like "slick" anaesthetists. It is said that the juniors feared the need for surgery, in case they had to have one of the Professor's anaesthetics. But deep down they knew that the professor was driven by compassion for his fellow man.

Pask married late in life. It may have been that the huge risks he took in the Second World War prevented him from marrying, only to leave a widow. It may also have been out of respect for his staunchly Methodist mother, because his wife to be, Muriel, was a Catholic. They did not marry until after

the death of his mother. They bought a cottage on the Isle of Man as a retreat, and family trips there to 2 Queen Street, Castletown took place whenever they could, especially after their daughter Susan was born. Pask also travelled to America and Canada many times. At one point, he was considering moving to McGill University in Montreal, but his ill health precluded the move. He suffered from Crohn's disease, and had a number of not wholly successful operations that left him increasingly unwell. He died suddenly, on the 30th May 1966, at the age of only 53. He left many shocked and saddened friends, and the letters of condolence came from the worlds leading anaesthetists. He left relatively few published papers and no textbooks to remember him by, but he had set the direction for many who were to be anaesthesia's future leaders. Sadly, today, he is virtually forgotten, even in Newcastle.

Acknowledgements

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