

## Hepatitis B: Prevalence, Hope

John Hedley-Whyte, M.D., F.A.C.P., F.R.C.A., Debra R. Milamed, M.S.

Accepted: 15th January 2019

Provenance: Internally reviewed

**Key Words:** Mentors, Virology,

### INTRODUCTION

In the transcript of his Nobel Oration for the 1976 Award in Physiology or Medicine, Baruch S. Blumberg refers to David Surrey Dane nine times.<sup>1</sup> Dane joined the Queen's Belfast Microbiology Department in 1955. He was soon promoted to Senior Lecturer, then Reader. In 1966 Dane was called to a Chair of Microbiology at the University of London tenable at the Bland-Sutton Institute and the Middlesex Hospital. Baruch S. (Barry) Blumberg (Fig. 1), David Surrey Dane (Fig. 2), Michael G.P. Stoker (Fig. 3) and Wolf Szmunn



Fig 1. Baruch Samuel Blumberg (1925-2011). Oil on canvas, 1993 by Paul Brason, RP (b.1952), 118" X 86", Balliol College Portraits Collection No. 174. Master of Balliol 1989-94. Baruch Blumberg entered the U.S. Navy in 1942 and rose to command a U.S. Navy Landing Ship (Tank). Blumberg was winner of the 1976 Nobel Prize and elucidator of the hepatitis virus which still infects over 270 million persons. Reproduction rights granted solely for this Medical History.

were responsible for wide-ranging advances in alleviation of pandemic Hepatitis B. This quartet of physician scientists each had outstanding World War II records and post-war guidance: each was a personable and talented leader<sup>2,3,4,5,6,7</sup>.

### EDUCATION

David Maurice Surrey Dane was educated at Charterhouse School, Surrey, England (Fig.2). In October 1942 he was gazetted as a Second Lieutenant in the British Army<sup>8</sup>. In 1943, Dane joined the British Parachute Regiment and was seconded to the Special Air Service (SAS). Having been

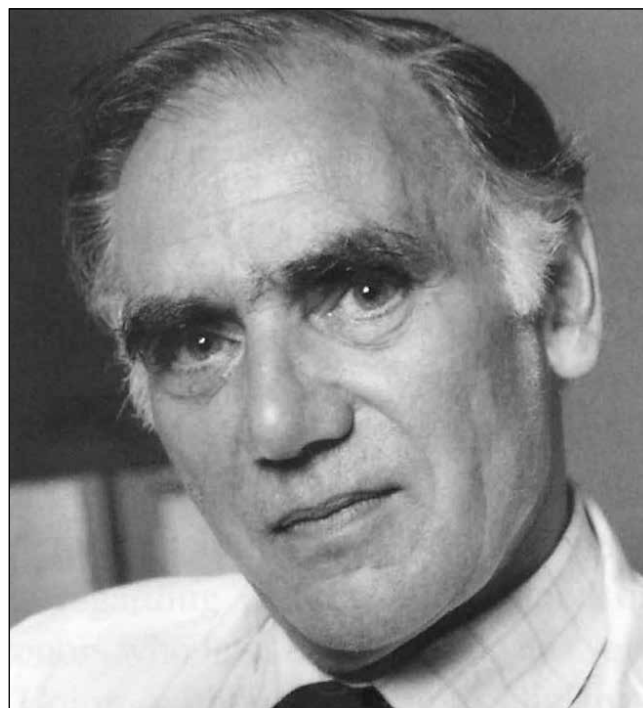


Fig 2. David Surrey Dane (1923-1998). Photograph reproduced with permission of *Vox Sanguinis*<sup>18</sup> exclusively for this Medical History. After a distinguished academic career at Queen's Belfast and London University, Professor David Surrey Dane contributed greatly to donor screening protocols to assure the safety of the British blood supply. His approach was always, "meticulous, patient and sensible". For many years, until 1995, DSD was advisor to the U.K. Ministers of Health.

David S. Sheridan Professorship in Anaesthesia and Respiratory Therapy, Harvard University, 1400 VFW Parkway, Boston, MA 02132-4927 USA

E-mail: john\_hedley-whyte@hms.harvard.edu

Correspondence to Prof. John Hedley-Whyte



UMJ is an open access publication of the Ulster Medical Society (<http://www.ums.ac.uk>).

The Ulster Medical Society grants to all users on the basis of a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Licence the right to alter or build upon the work non-commercially, as long as the author is credited and the new creation is licensed under identical terms.

taught in Northern Ireland to organize the construction of clandestine advanced landing strips, Dane wrote, "I saw a Coastal Command Hudson which crashed and blew up in spectacular fashion when coming in to land at Aldergrove aerodrome with a full load of depth charges on board"<sup>9</sup>.

Dane was dropped at 1:00 a.m. on 28th June 1944 from an RAF Stirling bomber into a field 250 miles east of Normandy<sup>9,10</sup>. After exit, his parachute collapsed then reopened at low level. As part of SAS Operation Bulbasket in Nazi-occupied France, Dane organized the building of advanced landing strips; Dane's main French strip was named Bon Bon. On 7<sup>th</sup> August 1944 Wing Commander Alan Boxer and Flight Lieutenant Abbott flew two Lockheed Hudsons into Bon Bon to evacuate Allied survivors of Bulbasket: thirty-five out of fifty-five, 64 percent, had been lost<sup>9</sup>. Dane had to wait at Bon Bon for four more days until a USAAF C-47 (DC3) arrived, piloted by Colonel Clifford Heflin who picked up Dane, five USAAF pilots shot down by German forces, and two British signalmen<sup>9</sup>. Colonel Heflin later became commander of the 216<sup>th</sup> Army Air Forces Base Unit Special Airfield for the Manhattan Project and was awarded the Legion of Merit by Eisenhower, and the French Cross of War and Legion of Honor<sup>11</sup>.



Fig 3. Sir Michael George Parke Stoker CBE FRS MD FRCP (4 July 1918 – 13 August 2013). Master of Clare Hall, Cambridge University; elucidator of the polymorphism of viruses, bacteria and cancers. Central panel of triptych, black-and-white drawing of three former Masters of Clare Hall by Bob Tulloch (1950-), 1988, 13.5" by 10.25". Reproduced with permission of the artist and Clare Hall.

SAS HQ staff did not appreciate Boxer's refusal to repeat flying an RAF Lockheed Hudson into Bon Bon necessitating Colonel Heflin to fly in his C-47. SAS HQ telegraphed "Bulbaskets to you Boxer"<sup>9,10</sup>. Boxer was later knighted. Boxer was technically correct: C-47s were more suited to Bon

Bon. By December 1943, one C-47 was being produced in the United States every thirty minutes<sup>12</sup> (Fig. 4).



Fig 4. "Green Light, Jump". Oil on canvas, 1994, 18" x 36". by Craig Kodera (1956-). Reproduction courtesy of the Greenwich Workshop, Inc., Turnbull, CT, solely for this Medical History. This painting depicts the arrival of C-47s into German-occupied France in June 1944.

In the spring of 1945, Dane took part in Operation Howard in which Regiment 1 of the SAS under Royal Ulster Rifleman Lieutenant Colonel Blair (Paddy) Mayne covered the 4<sup>th</sup> Canadian Armoured Division as they advanced to the Baltic through Northern Germany<sup>13</sup>. For exemplary heroism in bitter fighting, fellow Ulsterman Field Marshal Montgomery recommended fellow Ulsterman Mayne for the Victoria Cross. In his Memoirs, Montgomery writes "In the end we beat the Russians to Lübeck on the 2<sup>nd</sup> May 1945 and thus sealed off the Danish peninsula with about six hours to spare before the Russians arrived"<sup>13</sup> (Fig.5). Dane wrote for Field Marshal Montgomery one of three testimonials for Mayne's VC: finally it became, although almost unprecedented, a third bar to Mayne's DSO<sup>14,15,16,17</sup>.

Dane arrived at Clare College, Cambridge in October 1945 to read Honours Natural Science Tripos<sup>18,19</sup>. Unusual for an undergraduate, although he had been an active member of the Charterhouse Bird Club<sup>20</sup>. While at Clare, Dane published three different papers on epidemics in Manx shearwaters in Skomer and Skokholm islands off Pembrokeshire<sup>21,22,23</sup> (Fig.6). The co-author of one paper was Michael G.P. Stoker, Dane's and later my\* Clare Medical Tutor<sup>23,24,25</sup> (Fig. 3). On 2 February 1948 Dane wrote from Clare College to *Ibis* about the severe outbreaks of "disease among juvenile Manx shearwaters, *Puffinus, puffinus*" in 1946 and 1947<sup>22</sup>. Juvenile Manx shearwaters develop blisters on webs of their feet and or conjunctivitis, frequently followed by early death before leaving their natal burrow<sup>25,26</sup>.

It has been estimated that approximately half of the world's Manx shearwaters are born on the coasts of St. George's and North Channels. The 300-acre Old Lighthouse Island, situated two-and-a-quarter miles off the coast from Donaghadee North Down, Northern Ireland, is the second most prolific site of hatching<sup>27</sup>.

About five weeks after hatching, parents leave the area, and the offspring a week or so later. By banding it has been shown

\* This and any other first-person references refer to the first author.

that Manx shearwaters migrate across the Atlantic to Brazil and the United States<sup>27,28</sup>. On the way they seem to rest and refresh at human watering holes like Biarritz and the beaches of Sao Paulo, Brazil. Currently, twenty-six are visiting Cape Cod, Massachusetts<sup>28</sup>. Manx shearwaters can take as little as twelve days to fly from Boston's Logan Airport area beaches to Northern Ireland or the West of Scotland—roughly the same time duration as the 1846 news of the success of diethyl ether in anaesthesia and surgery<sup>29</sup>.



Fig 5. Field Marshal Bernard Law Montgomery (1887-1976), the First Viscount Montgomery of Alamein, KG, GCB, DSO, Hon. LLD Queen's University Belfast: son of the Rt Rev H.H. Montgomery KCMG and Lady Montgomery, by Terence Tenison Cuneo (1907-1996), 1972, oil on canvas, 125 cm x 100 cm. From the collections of the Defense Academy of the United Kingdom, Watchfield, Shrivenham, Oxfordshire, and reproduced with their permission, solely for this Medical History.

After passing Conjoint in 1951 from St. Thomas's Hospital, Dane emigrated to Australia. In the spring of 1955, Dane returned from the Institute of Medical and Veterinary Science in Adelaide<sup>18,19,30</sup> to Clare and Cambridge, from which in 1955 he received an M.B., and I received a B.A. Also in 1955 David Surrey Dane married Veronica Tester Hope, a widow, with two children Kerin and Alex. This family of four moved forthwith to Belfast, where the Danes later had three additional children: Roland, Penelope and Thomas<sup>18,19</sup>. That same year, 1955, Dane joined Professor George Dick's Department at Queen's University, Belfast, where in the winter of 1956 they developed plans for a Virus Reference Laboratory which became operational within the year<sup>18,19,30,31</sup>. Dane also started a research programme "which aimed at

identifying human hepatitis viruses by electron microscopy"<sup>32</sup>. In 1969, "some doubted whether Australian antigen was specifically related to hepatitis B virus"<sup>32</sup>. In a letter invited by Eugene Garfield to *Current Contents* in 1980, Dane wrote that he "thought that [by the 1960s] EM and negative staining techniques had developed to the stage where they could be used by virologists"<sup>32</sup>. Dane and his Belfast coworkers used specimens negatively stained with "4% phosphotungstic acid at pH 6.5 and applied to formvar/carbon grids before examination in an A.E.I. EM 801 electron microscope"<sup>33</sup>. Hepatitis B virus was found by Dane to be a particle 42 nm in diameter with DNA and DNA polymerase<sup>3,32</sup>, later eponymously named the "Dane particle"<sup>32</sup>. Dane wrote that "I never discovered whether the person who originally referred to it this way was a well-wisher who thought we were right or someone who hoped we were wrong"<sup>32</sup>.

### OXONIAN MYSTERY

In 1978, 19 Manx shearwaters sick with puffinosis were transported live to Oxford from Skomer and Skokholm islands. A homogenate from each freshly decapitated bird was injected separately into Oxford Dunn Pathology mice randomly inbred since 1953. One to 3 day old suckling mice were injected intracerebrally and subcutaneously. Eight to 11 day old fertile hens' eggs were injected as also were various cell cultures.

Two days after inoculation, two of the mice showed clinical signs of infection, one with paralysis. Sera from the Manx shearwaters were not collected after inoculation due to "difficulties keeping the birds" in Oxford<sup>26</sup>. The virus that was isolated differed from that found in 1948 by Stoker<sup>33</sup>. Probably the coronavirus at Oxford they discovered was from an Oxford Dunn School of Pathology mouse. Electron microscopy was non-diagnostic of puffinosis. Nuttal and Harrap, whose work was funded by the National Environment Research Council (NERC), stated "We are studying puffinosis because, unlike many epizootics in wild animal populations detailed investigation is possible"<sup>26</sup>.

According to Michael Stoker on a visit to me at Harvard Medical School<sup>34</sup>, David Dane thought that the Oxonians had wider aims. Stoker told me that the study had led to Clare discussions. Did Oxford want to allot to Manx shearwaters the role of carrier pigeons? Or were they manufacturing an opportunity to test their electron microscopy specimen preparation and imaging techniques? We concluded, said Stoker, we should not ascertain.

### ADVANCES AGAINST HEPATITIS B IN THE U.S.

Warsaw-born Wolf Szmunes, who had studied medicine in Italy, returned to his family in Poland after the 1939 German invasion. He then fled to the Soviet Union where he was confined to a Siberian labour camp at which he was eventually assigned duties of sanitation management and epidemiologic records. Post-release he received a medical degree from the University of Tomsk in 1950, an advanced scientific degree from the University of Kharkov in 1955 and



an additional degree from the University of Lublin in 1964. In 1968 he left Poland with his family and emigrated to the United States where he met with Dr. Aaron Kellner, President of the New York Blood Center to discuss career prospects<sup>2,4</sup>. They consulted Barry Blumberg (Fig.1) and together decided that Szmunes should work as Kellner's technician. Wolf Szmunes published in 1980 on the efficacy of Blumberg anti-hepatitis B vaccine produced by Merck in a Controlled Clinical Trial in a high-risk New York Population<sup>5</sup>.

### DAVID SURREY DANE'S AND MY MEDICAL TUTOR AT CLARE

Michael Stoker was born in Taunton, Somerset on 4 July 1918 just after his Corkonian physician father, Cork Medical School-educated, had returned from France with an M.C.<sup>24,35,36,37,38,39</sup> and relocated the family to Market Harborough. Michael, aged 8, was sent as a boarder to Oakham and thence to Sidney Sussex, where the pre-Cromwellian silver fascinated him and Veronica English. They married in 1942, the year Michael passed conjoint. In 1943 Michael was sent as an RAMC Lieutenant to the 3<sup>rd</sup>/9<sup>th</sup> Ghurkas in Northern India<sup>39</sup>. Douglas Black, later PRCP, London, arranged for Stoker to enroll in a course in laboratory medicine run by William Haye, a bacterial geneticist in Poona. Together they studied virus activity in Herpes simplex and the bacterial antigenic variation of Rickettsiae. After World War II, Henry Thirkill, M.C., Master of Clare, called Michael Stoker and Veronica and their son to Clare, with Michael as Clare Medical Tutor for Honours Natural Science Tripos.

From Clare, Michael Stoker expanded the horizons of H.R. Dean's Cambridge Department of Pathology. Stoker used electron microscopes in the Cavendish Laboratory of Rutherford and later Pippard<sup>40</sup>.

As we were Stoker's tutees our job was to educate Stoker: subjects such as Antigenicity versus Infectivity. Polymorphism—"have you chased the Beagle?" What about the scientific verse of Grandfather Erasmus? What about Medical Management of the aftermath of the Quetta Earthquake?<sup>41,42</sup> Much of these discussions took place in Veronica's house, not at Clare.

### LONG TERM EDUCATION

After I went down from Cambridge, Stoker, for decades would send me, his "perpetual student", a postcard after I had published in the Scientific or Medical Literature. Nearly all messages were short. "Congratulations." "Surprising but believable". "Talk to Aage Bohr". Re: our ICU and Thomas Huckle—"Do it"<sup>43,44</sup>.

In 1961-1962 while I worked on "impaired oxygenation in surgical patients" at Harvard<sup>45,46</sup>. Michael Stoker, now Professor of Virology at Glasgow, advised as to the management of viremia<sup>44</sup>. My Harvard Department Heads E.D. Churchill and H.K. Beecher<sup>47</sup> along with M.G. Stoker declined co-authorships:"that is not our style"<sup>44,46</sup>.

### STOKER FAMILY RELOCATIONS

After Clare, the Stokers had nine years in Glasgow, then California, then great success from 1968 at the Imperial Cancer Research Fund Laboratories introducing Genetics and more fundamental Molecular Biology. Michael used to say his co-workers and tutees converted him from Virology to Cell Biology. Knighted in 1980<sup>48</sup>, from London he and Veronica went back to head up Clare Hall for seven happy years. Then Michael returned to his Cambridge Pathology Laboratory to continue work on hepatitis B and hepatocellular cancer<sup>49,50,51,52</sup>.



Fig 6. Manx Shearwaters over the Sea, lithograph of 1967 painting by Keith Shackleton (1923-2015).

### GLOBAL SITUATION

Each year an estimated 887,000 humans are killed by hepatitis B<sup>53</sup>; how many thousands of non-humans we do not know. Hepatitis B has solely infected humans and other hominidae and simian species for at least the last 7,000 years<sup>54,55</sup>. Currently hepatitis B infects 257 million people worldwide<sup>53,56</sup>. The "Northern Ireland Hepatitis B and C Managed Clinical Network" has reported that Northern Ireland is a "very low prevalence country" for hepatitis B<sup>57</sup>. Much progress has been made in vaccination of healthcare workers, as well as mothers and their offspring<sup>58,59</sup>.

Investigators from the Regional Virus Laboratory at the Royal Victoria Hospital, Belfast, with colleagues from the Liver Unit, Department of Genitourinary Medicine and HIV and the Public Health Agency of Northern Ireland have recently suggested a higher than expected rate of progression from acute to chronic hepatitis B among persons aged 50 and over in Northern Ireland<sup>60</sup>. Patients co-infected with HIV show hepatitis B chronicity rates as much as six times higher than hepatitis B patients who are HIV seronegative. While such co-infection is relatively rare in Northern Ireland, the overall aging of the population amid higher hepatitis B chronicity rates emphasizes the importance of vaccination and provision of accurate information to patients.<sup>60</sup>

"This plague has come upon us by infection and will spread still further"<sup>61</sup> †. Before you travel to foreign parts ascertain your vaccination status<sup>56</sup>.

† "...dedit hanc contagio labem et dabit in plures..." (Juvenal, Satvra II, 78-9).

## ACKNOWLEDGEMENTS

The authors wish to thank Ms. Anna Sander, Archivist and Curator of Manuscripts, and Professor Seamus Perry, Balliol College Oxford, for assistance with permission to reproduce the portrait of Baruch S. Blumberg. The authors wish to thank Mrs. Catherine Smith, Archivist, Charterhouse School, for archival material about alumnus David M. Surrey Dane. The authors wish to thank the editors of *Vox Sanguinis* for permission to reproduce the photograph of David Surrey Dane. The authors wish to thank Prof. Frances Spalding and the Fellows of Clare Hall, and artist Bob Tulloch for permission to reproduce the portrait of Sir Michael Stoker. The authors wish to thank the staff of the Defense Academy of the United Kingdom for permission to reproduce the portrait of Field Marshal Montgomery. The authors wish to thank the representative of the estate of the late Keith Shackleton, for permission to reproduce the lithograph based on Shackleton's 1976 painting "Manx Shearwaters over the Sea."

## REFERENCES

- Blumberg BS. Nobel Lecture. Australia antigen and the biology of hepatitis B December 13, 1976. The Official Web Site of the Nobel Prize [Internet]. Stockholm: Sweden: Nobel Media, AB; c1994-2018. Available from: [https://www.nobelprize.org/nobel\\_prizes/medicine/laureates/1976/blumberg-lecture.html](https://www.nobelprize.org/nobel_prizes/medicine/laureates/1976/blumberg-lecture.html) [Last accessed March 2019].
- Blumberg BS. *Hepatitis B. The hunt for a killer virus*. Princeton, NJ: Princeton University Press; 2002.
- Dane DS, Cameron CH, Briggs M. Virus-like particles in serum of patients with Australia- antigen-associated hepatitis. *Lancet*. 1970;**1(7649)**:695-8.
- Altman LK. Dr. Wolf Szmunes is dead at 63: An epidemiologist and researcher. *New York Times*. 1982 Jun 8. Available from: <https://www.nytimes.com/1982/06/08/obituaries/dr-wolf-szmunes-is-dead-at-63-an-epidemiologist-and-researcher.html> [Last accessed March 2019].
- Szmunes W, Stevens CE, Harley EJ, Zang EA, Oleszko WR, William DC, et al. Hepatitis B vaccine: demonstration of efficacy in a controlled clinical trial in a high-risk population in the United States. *N Engl J Med*. 1980;**303(15)**:833-41.
- Lustbader ED, London WT, Blumberg BS. Study design for a hepatitis B vaccine trial. *Proc Nat Acad Sci USA*. 1976;**73(3)**:955-9.
- Fulford KW, Dane DS, Catterall RD, Woof R, Denning JV. Australia antigen and antibody among patients attending a clinic for sexually transmitted diseases. *Lancet*. 1973;**1(7818)**:1470-3.
- Reconnaissance Corps. The undermentioned Cadets to be 2<sup>nd</sup> Lts. 19 Sept. 1942:-- ...David Maurice Surrey-Dane (245239). *Second Supplement to the London Gazette of Tuesday, the 13<sup>th</sup> of October, 1942*. Friday, 16 October 1942, issue 35746, p.4483. Available from: <https://www.thegazette.co.uk/London/issue/37091/supplement/2654/data.pdf>. [Last Accessed March 2019].
- McCue P. *SAS Operation Bulbasket. Behind the lines in occupied France*. London: Leo Cooper; 1996. p.109-12, 125-30, 161,166,171,176,179.
- Kemp A. *The SAS at war: The Special Air Service Regiment 1941-1945*. Chapter 8. 1. SAS in France. London: John Murray Ltd; 1991. p.142-69.
- Clifford Heffin. Colonel, Wendover, UT, Europe, United Kingdom. Manhattan Project Veteran, Military Veteran. Available from: <https://www.atomicheritage.org/profile/clifford-heffin>. [Last Accessed March 2019].
- Wolfe M. *Green Light. A Troop Carrier Squadron's War from Normandy to the Rhine*. Chapter 8. Flying. Plane, pilots and crew. Washington, D.C.: Center for Air Force History; 1993. p.125-44.
- Montgomery BL, Viscount Montgomery of Alamein. *The Memoirs of Field-Marshal Montgomery of Alamein, K.G.* Cleveland, Ohio: World Publishing; 1958. p. 296-8.
- The Distinguished Service Order. Lieutenant Robert Blair Mayne (87306), The Royal Ulster Rifles. *Second Supplement to the London Gazette of Friday, the 20<sup>th</sup> of February, 1942*, Tuesday, 24 February 1942. No. 35465: p.894. Available from: <https://www.thegazette.co.uk/London/issue/35465/supplement/1>. [Last Accessed March 2019].
- Bar to the Distinguished Service Order: Captain (temporary Major) Robert Blair Mayne, D.S.O., M.C. (87306), Infantry (Belfast). *Supplement to the London Gazette of Tuesday, the 19<sup>th</sup> of October 1943*, Thursday, 21 October, 1943. No. 36217, p. 4661. Available from: <https://www.thegazette.co.uk/London/issue/36217/supplement/1>. [Last Accessed March 2019].
- Second Bar to the Distinguished Service Order: Major (temporary Lieutenant- Colonel) Robert Blair Mayne, D.S.O. (87306), Army Air Corps (Belfast), D.S.O. (87306), Army Air Corps (Belfast). *Supplement to the London Gazette of Tuesday, the 27<sup>th</sup> of March, 1945*, Thursday, 29 March 1945. No. 37004, p. 1709. Available from: <https://www.thegazette.co.uk/London/issue/37004/supplement/1>. [Last Accessed March 2019].
- Third Bar to the Distinguished Service Order: Lieutenant-Colonel (temporary) Robert Blair Mayne, D.S.O. (87306), 1st Special Air Services Regiment, Army Air Corps (Belfast). *Supplement to the London Gazette of Tuesday, the 9<sup>th</sup> of October, 1945*, Thursday, 11 October 1945. No. 37302. p. 5004. Available from: <https://www.thegazette.co.uk/London/issue/37302/supplement/1>. [Last Accessed March 2019].
- Barbara JA. David Surrey Dane 1923-1998 Obituary. *Vox Sanguinis* 1998;**75(3)**:177.
- Zuckerman AJ. David Maurice Surrey Dane. *R Coll Physician. Munk's Roll* 1998;11:141. Available from: <http://munksroll.rcplondon.ac.uk/Biography/Details/4976> [Last accessed March 2019].
- Garnett TR. Bird club. *The Carthusian*. 1942;**18(14)**:302.
- Dane DS. A disease of Manx shearwaters (*Puffinus puffinus*). *J Anim Ecol* 1948;**17**:158-64.
- Dane DS. Disease of shearwaters. *J Anim Ecol*. 1948;**90**:340-1.
- Dane DS, Miles JA, Stoker MG. A disease of Manx shearwaters: further observations in the field. *J Anim Ecol*. 1953; **22(1)**:123-33.
- Sir Michael Stoker. Obituary. *Telegraph*. 2013 October 3. Available from: <https://www.telegraph.com.uk/news/obituaries/10354282/Sir-Michael-Stoker.html> [Last accessed March 2019].
- Stoker MG, Miles JA. Studies on the causative agent of an epizootic amongst Manx shearwaters (*Puffinus p. puffinus*). *Epidemiol Infect*. 1953;**51(2)**:195-202.
- Nuttall PA, Harrap KA. Isolation of a coronavirus during studies on puffinosis. A disease of the Manx shearwater (*Puffinus puffinus*). *Arch Virol*. 1982;**73(1)**:1-13.
- Lockley RM. *Shearwaters*. Chapter X1. Migration. London: J.M. Dent and Sons Ltd; 1942. p.116-33.
- Birdwatching. *Boston Globe*. 2018 Jun 20: G8. Available from: <https://www.bostonglobe.com/metro/2018/06/23/bird-sightings/SzirXgCZPx2UcoZtYG2CvN/story.html>. [Last accessed March 2019].
- Ellis RH. The introduction of other anaesthetics to Great Britain. 1. How the news was carried from Boston, Massachusetts to Gower Street, London. *Anaesthesia*. 1976;**31(6)**:766-77.
- Surrey Dane. On 9<sup>th</sup> April 1998. Dr. David Maurice Surrey Dane, aged 75. G OQ1936-LQ1941. *Charterhouse News Sheet*. No. 76, October 1998. Goldaming, Surrey: The Charterhouse School.
- Dick GW, Dane DS. The Virus Reference Laboratory. *Ulster Med J*. 1958;**27(1)**:47-52.



UMJ is an open access publication of the Ulster Medical Society (<http://www.ums.ac.uk>).

The Ulster Medical Society grants to all users on the basis of a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International Licence the right to alter or build upon the work non-commercially, as long as the author is credited and the new creation is licensed under identical terms.

32. Dane DS. Letter, October 17, 1980. This Week's Citation Classic. *Current Contents Life Sciences*, No. 45, November 10, 1980. p.26.
33. Miles JA, Stoker MG. Puffinosis: a virus epizootic of the Manx shearwater, *Puffinus p. puffinus*. *Nature*. 1948;**161(4104)**:1016.
34. University News. Harvard University Promotes Dr. J. Hedley-Whyte to Professor of Anaesthesia. *Nature* 1969 June 28; **222(5200)**:1310.
35. Bodmer W. Sir Michael Stoker Obituary. Director of the Imperial Cancer Research Fund laboratories who turned the ICRF into a world-renowned organization. *The Guardian*. 2013 Aug 27. Available from: <https://www.theguardian.com/science/2013/aug/27/sir-michael-stoker> Last accessed March 2019. [Last accessed March 2019].
36. Edwards P. Professor Sir Michael Stoker: Towering figure in cancer research. *Independent*. 2013 Sept 10. Available from: <https://www.independent.co.uk/news/obituaries/professor-sir-michael-stoker-towering-figure-in-cancer-research-8805613.html>. [Last accessed March 2019].
37. Weiss RA, Burke DC. Obituary: Sir Michael Stoker 1918-2013. Microbiology Society. 29 May 2014. Available from: <https://microbiologysociety.org/publication/past-issues/world-war-i/article/obituary-sir-michael-stoker-1918-2013.html> [Last Accessed March 2019].
38. Weiss RA, Gherardi E. Obituary Michael Stoker 1918-2013. *Cell*. 2013;**155(3)**:493-4.
39. Taylor-Papdimitriou J. Michael George Parke (Sir) Stoker. *R Coll Physicians: Munk's Roll*. 2013;12: webpage. Available from: <http://munksroll.rcplondon.ac.uk/Biography/Details/6695>. [Last accessed March 2019].
40. Ruska E, Binnig G, Rohrer H. Nobel Lecture. The development of the electron microscope and of electron microscopy. Nobel Lecture, December 8, 1986. Alfred Nobel Memorial Foundation, Nobel Media AB. Nobelprize.org. The Official Web Site of the Nobel Prize [Internet]. Stockholm: Sweden: Nobel Media, AB; c1994-2018. Available from: <https://www.nobelprize.org/prizes/physics/1986/ruska/lecture/>. [Last accessed March 2019].
41. Hedley-Whyte J, Milamed DR. FDR and American Military Deployment: "My" Armed Forces and their Health. *Ulster Med J*. 2018;**87(1)**:39-45.
42. Slessor J. Chapter V. Disaster at Quetta. In: *The Central Blue: The Autobiography of Sir John Slessor, Marshall of the RAF*. New York: Frederic A. Praeger; 1957.p.101-18.
43. Enders JF, Weller TH, Robbins FC The cultivation of the poliomyelitis viruses in tissue culture. Nobel Lecture, December 11, 1954. Available from: [https://www.nobelprize.org/nobel\\_prizes/medicine/laureates/1954/enders-lecture.html](https://www.nobelprize.org/nobel_prizes/medicine/laureates/1954/enders-lecture.html) [Last accessed March 2019].
44. Hedley-Whyte J, Burgess GE III, Feeley TW, Miller MG. Chapter 21. Applied respiratory physiology and management of cerebral edema, infection and hemorrhage. Respiratory management and prognosis of viral infections of the central nervous system. In: *Applied Physiology of Respiratory Care*. Boston: Little, Brown and Co.; 1976. p.279-82.
45. Bendixen HH, Hedley-Whyte J, Laver MB. Impaired oxygenation in surgical patients during general anesthesia with controlled ventilation. A concept of atelectasis. *New Engl J Med*. 1963;**269(19)**:991-6.
46. Hedley-Whyte J. Intra-abdominal surgery and anesthesia management: Classic Papers Revisited. *Anesthesiology*. 2017;**126(3)**:543-6.
47. Hedley-Whyte J., Milamed DR. Our blood your money. *Ulster Med J*. 2013;**82(2)**:114-20.
48. Central Chancery of the Orders of Knighthood: Professor Sir Michael George Parke Stoker, C.B.E. Knighted 2<sup>nd</sup> December 1980, London, UK, *The London Gazette*, Friday, 16<sup>th</sup> January 1981. No. 48496. p.643. Available from: <https://www.thegazette.co.uk/London/issue/48496/page/1> [Last accessed March 2019].
49. Stoker MG. Effects of tumour viruses on cell growth. *J Clin Path Suppl (R Coll Pathol)*. 1974; **27(7)**: 60-4.
50. Gherardi E, Stoker M. Hepatocytes and scatter factor. *Nature*. 1990; **346(6281)**:228.
51. Gherardi E, Stoker M. Hepatocyte growth factor—scatter factor: mitogen, motogen and met. *Cancer Cells*. 1991;**3(6)**:227-32.
52. Gherardi E, Sharpe M, Lane K, Sirulnik A, Stoker M. Hepatocyte growth factor/scatter factor (HGF/SF), the c-met receptor and the behavior of epithelial cells. *Symp Soc Exp Biol*. 1993;**47**:163-81.
53. WHO. Global Hepatitis Report 2017. Geneva: WHO; 2017. Available from: <http://www.who.int/hepatitis/publications/global-hepatitis-report2017/en/>. [Last accessed March 2019].
54. Krause-Kyora B, Susat J, Key FM, Kuhnert D, Bosse E, Immel A. Neolithic and medieval virus genomes reveal complex evolution of Hepatitis B. *eLife*: 2018 May 10;7. e36666.
55. Mühlemann B, Jones TC, Damgaard PB, Allentoft ME, Shevina I, Logvin A, *et al*. Ancient hepatitis B viruses from the Bronze Age to the Medieval period. *Nature*. 2018;**557(7705)**:418-23.
56. Abara WE, Qaseem A, Schillie S, McMahon BJ, Harris AM, High Value Care Task Force of the American College of Physicians and the Centers for Disease Control and Prevention. Hepatitis B vaccination, screening and linkage to care: Best practice advice from the American College of Physicians and the Centers for Disease Control and Prevention. *Ann Intern Med*. 2017;**167(11)**:794-804.
57. HSC Public Health Agency. NI Regional Hepatitis B & C Managed Clinical Network Annual Report 2017. Belfast, Northern Ireland: HSC Public Agency. Available from: [https://www.hepbandcni.net/sites/default/files/2017%20Annual%20Network%20Report%20Final\\_0.pdf](https://www.hepbandcni.net/sites/default/files/2017%20Annual%20Network%20Report%20Final_0.pdf). [Last Accessed March 2019].
58. McKee CM, Dinsmore WW. Hepatitis B immunisation in Northern Ireland: an epidemiological and economic analysis. *Ir Med J*. 1989;**82(2)**:83-7.
59. Rice BD, Tomkins SE, Neube FM. Sharp truth: health care workers remain at risk of bloodborne infection. *Occupational Medicine*. 2015;**65(3)**:210-4.
60. McKeating C, Cadden I, McDougall N, Jessop L, Quah S, Lavelle M. Progression from acute to chronic hepatitis B is more common in older adults. *Ulster Med J*. 2018;**87(3)**:177-80.
61. Flacci AP, Ivvenalis DI. *Satvrae*. Clausen WV ed. D. Ivni Ivvenalis Satire II. Oxford: Oxford Classical Texts; 1959.

