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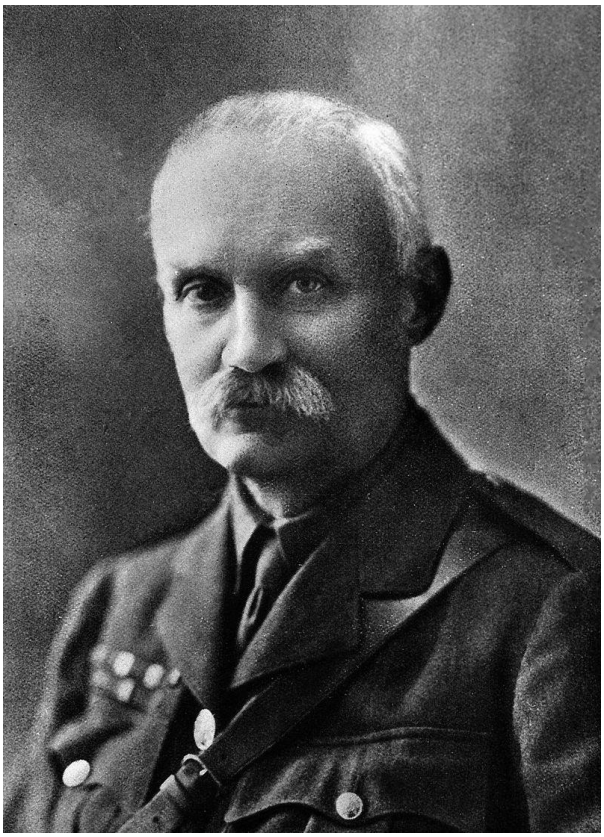
HEALTH FOR HEROES: A BRIEF HISTORY

Compiled and updated from previous IBMS Congress poster material by Brian Nation, Professor Mike Wren, Dr David Petts and Michael Wright, on behalf of the IBMS History Committee



Sir German Sims Woodhead

In addition to his contribution to pathology and the health of those involved in conflicts around the world, Professor Sims Woodhead played a pivotal role in the gestation and birth of the Pathological and Bacteriological Laboratory Assistants' Association (PBLAA; now the Institute of Biomedical Science). He became President of the Association, and is honoured to this day through the Institute's highest accolade, the Sims Woodhead Medal, of which there have been just 26 recipients.

Health for Heroes: a brief history

Wren MWD, Petts D, Nation BR, Wright M, Sturdgess I, Wainwright A, Mortlock S, Mangan-Casbon J, Scott S, Burt C.
History Committee, Institute of Biomedical Science, 12 Coldbath Square, London EC1R 5HL, UK.

Correspondence to:
Brian Nation CSci FIBMS
Chairman, IBMS History Committee
Email: briannation@ibms.org

ABSTRACT

Over the past century and a half, the development of clinical and laboratory medicine has been inextricably linked to experiences gained in conflicts around the world. Here, members of the Institute of Biomedical Science History Committee explore the key milestones in this symbiotic medical relationship, and highlight the key practitioners who played pivotal roles in this field. In the late 19th and early 20th centuries, disease was the major contributing factor leading to morbidity and mortality in areas of conflict. With the increased knowledge about, and understanding of, blood loss, the focus changed to how the role of transfusion could be applied both on and off the battlefield.

HISTORICAL PERSPECTIVE

Prior to the early 20th century the majority of casualties were not due to hostilities but through suffering illness or death from disease, often as the result of poor hygiene or debilitating parasitic infestation. Prevalent disease at the time were typhoid, syphilis, yellow fever, tuberculosis, malaria, undulant fever, kala-azar and sleeping sickness. As each of these was conquered, the efforts turned to combating the effects of blood loss.

The Crimean War (1854–1856)

Within a few weeks of the British Army's arrival in the Crimea, around 8000 soldiers had contracted cholera or malaria. The swift spread of disease among wounded soldiers was mainly due to insanitary conditions in the hospitals. Most lacked effective sewerage and ventilation, there was severe overcrowding, and many more soldiers died from cholera and dysentery than from battle wounds.

As the incompetence of the medical services in the Crimea became common knowledge, Edmund Alexander Parkes (1819-1876) was appointed to take charge of a temporary hospital at Renkioi in the Dardanelles to relieve pressure on the hospitals in Scutari.

After The Crimean War

As a result of the glaring faults of organisation in the Army Medical Department, a Royal Commission was convened. This highlighted issues that needed to be addressed; the commission ordered that sanitary experts should report on the suitability of proposed sites for Army hospitals and barracks, and

more suitable sanitation facilities should be supplied (eg properly dug sewers). There was inadequate provision of medical transport, which was run by veterans of previous campaigns. Many of these veterans suffered in ill health and consequently helped to spread infections such as cholera. Soldiers' exposure to extreme cold also resulted in ill health. The commission ordered the provision of suitable uniforms for different climates.

Royal Sanitary Commission (1858)

Edmund Parkes served on the Commission, which included Florence Nightingale, to investigate the health of troops, An Army Medical School was established with a brief to instruct young Medical Officers in medicine, surgery, hygiene and sanitary science. The first Army Medical School was set up at Fort Pitt in Kent, where Parkes became the first Professor of Military Hygiene. After three years the Army Medical School moved to the 1000-bed Royal Victoria Hospital at Netley, near Southampton Water. In 1863, Parkes produced his *Manual of Practical Hygiene*, which was to run to eight editions (1864–1891).

South African War (1899–1902)

The main killer in the war was again not the enemy but disease; 6000 British soldiers were killed in action, while 14,000 died of disease (8000 from typhoid: 74,000 were treated). The advice of the new Hygiene Officers was ignored, resulting in poor sanitation and drinking water. One problem was the long evacuation chain for casualties. Each soldier carried a field dressing which he was to apply to himself if wounded. The high number of deaths due to disease highlighted the need for strict hygiene procedures to be introduced into the hospitals. Sir Almroth Wright and Captain Leishman (who later became Director General of the Army Medical Services) started work on an anti-typhoid vaccine. Resultant vaccination of 10 million troops in the First World War (WW1) largely eliminated typhoid casualties.

Health & Fitness of Recruits

Of great concern at induction was the general bad health of the nation. Recruits were already weakened by poor nutrition, tuberculosis or typhoid, and were susceptible to further disease. High priority was given to raising the nutrition and the fitness of the civilian population to provide suitably fit men to defend the expanding empire and fight future wars.

Pure Drinking Water

Colonel William Horrocks RAMC developed the Horrocks Box. This device filtered water through sand in order to provide a portable method of purifying drinking water. It was particularly beneficial during WW1 in keeping Allied forces largely free from waterborne diseases. Dr (later Colonel and subsequently Professor Sir German) Sims Woodhead introduced chlorination of water in bowsers and devised a test for residual chlorine in the water. Its success laid the foundations for continuous water treatment to this day.

Antibacterial Revolution

In the decade from 1935 to 1945, a new class of medicines capable of controlling bacterial infections launched a therapeutic revolution that continues today. It began in the mid-1930s with the use of sulphonamides. Gerhard Domagk was jailed by the Gestapo for not refusing the Nobel Prize in Physiology or Medicine. He discovered and named the drug Prontosil, which was antibacterial. The effective metabolite was shown to be sulphanilamide. As it was not soluble in water, it was used as a powder to sprinkle on wounds and was later used to coat bandages. Domagk was able to collect his Nobel Prize in 1947.

Differential media especially designed to sequester species increased dramatically during World War 2; military hospitals developed clinical microbiology sections devoted not only to recognising agents endangering the health of troops in camps, in battle and in foreign environments, but also to assessing the responses of certain of the microorganisms isolated to several sulphonamides and that hitherto unknown agent penicillin.

Penicillin (discovered by Alexander Fleming in 1928) began to be available in limited amounts, and was first used to great effect in the North Africa campaign during WW2. Subsequently, Florey and Chain began a manufacturing process with the help of a fermentation plant devised by Margaret Rousseau to grow large amounts of the fungus. Pfizer helped in the packaging so that doses of penicillin were ready for the D-Day landings. It is estimated that penicillin saved 15% of the wounded from death or amputation.

Both of these agents carried the main therapeutic burden in both military and civilian medicine.

Heroes of Health

Since the inception in 1856 of the Victoria Cross award for bravery, just three individuals have each earned it twice. The double VC winners included two medical personnel, Lt Col Arthur Martin-Leake FRCS and Captain Noel Chavasse MRCS.

BRUCELLOSIS AND SLEEPING SICKNESS

Major General Sir David Bruce (1855–1931) was well known for his study of Malta fever (brucellosis) and sleeping sickness (trypanosomiasis). He was born in Australia but moved to Scotland aged five when his family returned home. He graduated from Edinburgh Medical School, becoming a great physician and a pioneer of veterinary microbiology. Captain Bruce proved that *Trypanosoma brucei* was the agent causing Nagana in cattle and sleeping sickness in humans, and that the tsetse fly *Glossina morsitans* was the vector transmitting the disease (1895).

Malta Fever

After a brief spell in general practice, Bruce commenced his military medical career by entering the Army Medical School at Netley, passing out top of the list in 1883, and in August that year was commissioned Surgeon Captain in the Army Medical Service. The following year he was posted to Valetta Hospital, Malta, which had no research facilities. Bruce provided his own microscope and equipment.

Impressed by Robert Koch's recent discovery of the tubercle bacillus, Bruce decided to investigate Malta fever, which annually hospitalised around a hundred soldiers of the British garrison for an average of three months. Malta fever was responsible for 120,000 days of disease each year. Following Koch's postulates, he identified *Micrococcus* (*Brucella*) *melitensis* (1887) as the aetiological agent of brucellosis in humans and cattle.

In 1905 Bruce headed the Commission for the Investigation of Mediterranean Fever where T Zammit, one of the Maltese members, found that goats' milk was the disseminating vehicle. When goats' milk was eliminated from the diet of the Malta garrison, the disease disappeared. This disease is now called brucellosis. The names 'Malta fever' or other names such as 'Mediterranean fever' or 'undulant fever' are no longer used.

Into Africa

In 1894 Bruce was posted to Natal at the request of the Governor, Sir Walter Hely Hutchison, a former Lieutenant Governor of Malta. Hutchison asked him to investigate an epizootic disease, Nagana, that was afflicting cattle in northern Zululand.

Captain and Mrs Bruce sailed for Pietermaritzburg, continuing the long journey to Ubombo by ox cart, in much the same way that David Livingstone had some 40 years previously. After trekking for five weeks, the Bruces arrived at Ubombo, where they lived for two months in a wattle-and-daub hut, using the veranda as a laboratory.

Nagana, a devastating disease, was killing large numbers of the Zulu's cattle. This had serious implications as the cattle were essential to their welfare and way of life. A similar disease known as Surra (*Trypanosoma evansi*) had been described in West Africa. In India a similar disease had been described that attacked horses, asses, mules and camels. In 1877 a surgeon, Timothy Lewis of the Royal Army Medical Corps, discovered a trypanosome in a rat while working in Bombay.

Continuing their work in South Africa, Captain David and Mary Bruce went on to investigate the outbreak of enteric fever during the Boer War. They were present at the siege of Ladysmith where Bruce commanded a Field Hospital. He returned home in 1901.

In 1903 Bruce was appointed head of the Royal Society's Sleeping Sickness Commission to Uganda. His team consisted initially of Dr David Nunes Nabarro and a Sergeant Technician. Dr A Castellani, the remaining member of the first commission, demonstrated trypanosomes in the cerebrospinal fluid of 25 victims before leaving. He taught Bruce the techniques for lumbar puncture and specimen examination. Here, *Trypanosoma gambiense* and the tsetse fly *Glossina palpalis* were the vector. Bruce left for Malta in 1904.

Bruce rejoined the commission in 1908, and in 1911 was appointed Director of the third commission and went to Nyasaland, with *Trypanosoma gambiense* and the tsetse fly *Glossina palpalis* being Implicated.

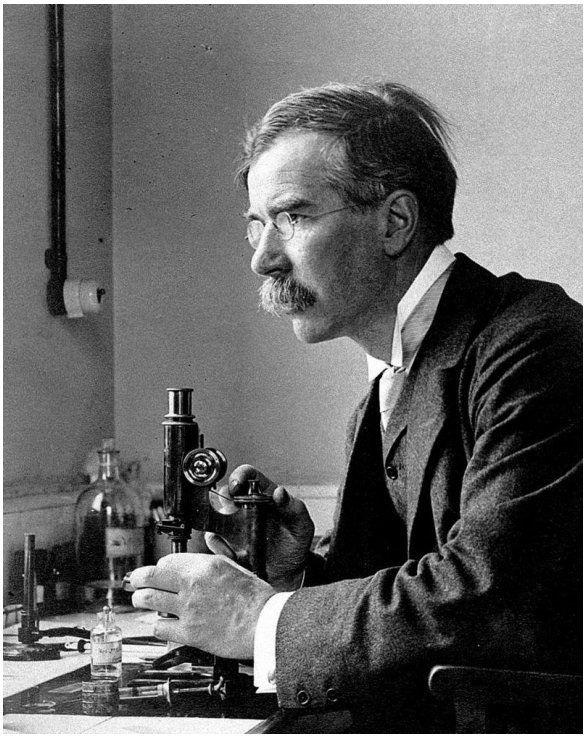
What is Trypanosomiasis?

Human African trypanosomiasis, sleeping sickness, African lethargy or Congo trypanosomiasis are estimated to currently infect 50,000 to 70,000 people, with numbers having declined somewhat in recent years. Four major epidemics have occurred in recent history: one from 1896–1906 primarily in Uganda and the Congo Basin. There were under 10,000 cases reported in 2009 according to WHO figures, which represents a huge decrease from the estimated 300,000 new cases in 1998. The disease has been recorded as occurring in 36 countries, all in sub-Saharan Africa. It is endemic in south-east Uganda and western Kenya, and killed more than 48,000 Africans in 2008.

Currently *Trypanosoma gambiense* is found in West Africa, *T. rhodesiense* in East Africa, and *T. brucei* in Zululand, causing Nagana.

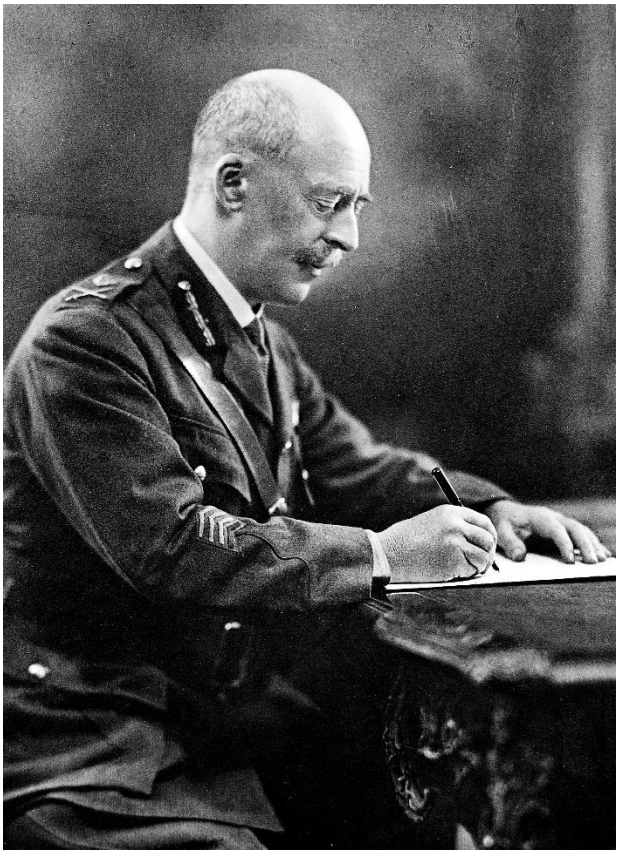
FIGHTING THE SCOURGE OF TYPHOID

Sir Almroth Edward Wright (1861–1947) was a pioneer of Medical Laboratory Science. He was qualified in both Modern Languages and Medicine and commenced his professional life as a Physiologist. After working in Europe and Australia he returned to London. In 1889 he worked at the conjunct research laboratories of the Royal College of Physicians and Surgeons where his supervisor, Professor Sims Woodhead, then advisor on Pathology to the British Army, recommended him to the post of Professor of Pathology at the Royal Army Medical College based at Netley. He was appointed in 1892 as a civilian, which led to some conflict with the other candidate, David Bruce, a serving



Sir Almroth Wright

Sir David Bruce, with Lady Bruce



Sir William Boog Leishman

Sir Ronald Ross

officer who was appointed Assistant Professor. An opinionated man, often aggressive when propounding his views, he was not always right, hence his nick-name “Sir Almost Right”. At the RAMC Netley he began his life's work on immunity.

Typhoid fever had a death rate of 10-30% at that time. In 1884 Gruber, Pfeiffer, Kolle and Widal had shown that patients who recovered from typhoid had antibodies in their serum that agglutinated the typhoid bacteria *in vitro* – The Widal Test was born.

Wright tested the effect of injection with heat-killed typhoid culture first on himself and co-worker Semple, then on 15 soldiers. He produced antibodies and immunity to typhoid. Despite bad side effects he then inoculated 2835 British soldiers going to India where typhoid was common. It appeared very few developed the disease.

In 1899 the War office agreed to inoculate soldiers heading for the Boer War but limiting it to volunteers only. Of the 448,000 dispatched only 14,000 were inoculated. Anecdotal evidence showed its worth when only half of the inoculated men developed the disease; however, record-keeping during the war was poor, and Wright had a deep aversion to statistics. This was seized upon by the leading biological mathematician of the time, Karl Pearson, who said the data showed nothing!

The War Office set up an inquiry which included David Bruce. It later sided with Pearson and judged the vaccine ineffective and the programme was suspended. Incensed by this, Wright resigned his post at Netley. Leishman, who was appointed as his successor, continued the work, modified the production method and improved the inoculum.

In 1902 Wright moved on to St Mary’s Hospital Medical School as Professor of Pathology and set up a vaccine and inoculation clinic.

Typhoid inoculation

Still convinced of the value of anti-typhoid vaccine, Wright started a production unit in partnership with Parke Davies and arranged for a second study on British troops stationed in India. The promising results were ignored by the Army. On the eve of war in 1914, Wright appealed to the War Office to inoculate troops against typhoid and petitioned Lord Kitchener, who agreed and ordered a mandatory inoculation programme. Thanks to 10 million vaccine doses produced at St Mary’s, Britain was the sole combatant with troops immunised against typhoid at the start of World War 1

Laboratory instruments

During this period, laboratory instruments were generally crude and home-made, so Wright – a pioneer in laboratory testing - made his own, developing and producing capillary tubes large enough to hold only a few drops of blood. With these instruments he could test blood without the necessity of drawing a great deal of it from a patient; all that was required was a fingerprick. Wright also recognised the importance of uniformity in laboratory testing, so he made sure each tube was identical.

In 1912 Wright published *Technique of the Teat and Capillary Glass Tube*. He demonstrated the opsonic effects of serum, the principle of antibody inoculation in bactericidal infections, the bacterial efficiency of the whole blood and phagocytes, and the influence of the antitryptic power of the serum on the growth of microbes. His team consisted of Freeman, Colebrook, Mathews, Fleming and others.

A different kind of battlefield

Flanders fields were cultivated and well manured, and horses were in common use around the battlefields. Soldiers living in the trenches became contaminated with mud containing faecal bacteria and bacterial spores.

Projectile wounds were caused by bombs, shell fragments and high-velocity bullets carried in filthy mud and fragments of soldiers' clothing. Most infective damage was caused by *Clostridium perfringens* (synonym *C. welchii*) causing gas gangrene, and *Clostridium tetani* causing tetanus.

For the period 1914–1918, Wright was appointed a consultant physician to the Army, with the rank of Colonel RAMC. Dispatched to France to set up a research laboratory attached to a hospital in Boulogne, he aimed to investigate the new problems of gunshot wound infection, gas gangrene and shock. He was assisted at varying times by his team from St Mary's Hospital.

Treatment of war wounds

Established thinking was based on the experience in the South African War. Here, the land was bare, dry and contained few pathogens. Projectile wounds were mainly from bullets fired from a distance, often passing through limbs, healing quickly without complication. This, together with accident ward experience in civil hospitals, led to the treatment of wounds with antiseptic solution. This Listerian tradition was blindly followed by military surgeons.

Together with Alexander Fleming, Wright showed that these antiseptics killed the macrophages and neutrophils that were gathering at the wound, and prevented healing; furthermore, the use of antiseptic paste encouraged the growth of anaerobes, with the fatal production of tetanus or gas gangrene. Wright's (successful) approach was to clean the wound with sterile hypertonic saline and suture it secondarily.

Therapeutic methods

Wright proposed three distinct therapeutic measures when dealing with wounds: i) treatment by antiseptics; ii) treatment by physiological methods such as opening and draining the wound to bring the antibacterial powers of blood to bear on the infecting microbes, cutting out damaged and infected tissue, applying hot fermentations (poultices) to induce active hyperaemia and increasing the outflow of lymph and lymphocytes, leaving operation wounds unsutured; and iii) treatment by vaccine therapy.

What would have happened without Wright's passion?

It took two or three years to overcome the old dogmas, by which time millions more lives had been lost. Would this have been achieved at all without Wright's passion and abrasiveness?

Maidstone Typhoid Outbreak (1897)

This was the largest outbreak of typhoid fever ever reported in the United Kingdom. It began in September 1897 and ended in January 1898, affecting nearly 2000 people, 143 of whom died. At its peak, 900 people contracted the disease in a two-week period. The cause was traced to contaminated mains water, and its continuing spread was linked to the poor state of the drainage system and the housing of many of the victims. It was a turning point in public health, featuring the first recorded trial of immunisation against typhoid and also disinfection of a mains water supply, using chloride of lime. This represented the first coordinated approach to control.

The typhoid immunisation trial was led by Almroth Wright. Staff at a large psychiatric hospital near Maidstone were asked to volunteer for the trial. None of the 84 who received the new vaccine developed the disease, compared with four cases in the 120 who were not vaccinated. This established the vaccine's potential value and led to larger trials.

The chlorination of the water supply, organised by the bacteriologist Professor Sims Woodhead, was a difficult procedure that required several attempts. Its success laid the foundations for continuous

water treatment. The Maidstone outbreak may also have been the first in which telephones were used in the control of an epidemic, allowing doctors and nurses in the emergency hospitals to pass on information about cases.

Tetanus antiserum

In 1899, Behring and Kitasako demonstrated that serum from another animal immune to a disease such as tetanus could be used to treat other animals (including humans) with the disease. This produces antitoxins that could be used to treat others effectively. Subsequently, an antitoxin was developed for tetanus

TROPICAL DISEASES

Each year there are, according to the World Health Organization, more than 249 million cases of malaria worldwide. The majority of the annual 627,000 death toll occurs in young children in sub-Saharan Africa. Altogether, 90% of the malaria-related deaths occur in this region. Malaria is commonly associated with poverty and can indeed be its cause, which in turn is a major hindrance to economic development.

Malaria

Sir Ronald Ross (1857–1932) graduated from St Bartholomew's Hospital Medical School in 1881 and joined the Madras branch of the Indian Medical Service (IMS). He studied malaria between 1881 and 1899 at the Presidency General Hospital, Calcutta. In 1883, Ross was posted as the Acting Garrison Surgeon at Bangalore during which time he noticed the possibility of controlling mosquitoes by inhibiting their access to water. In 1897, Ross was posted in Ooty and fell ill with malaria. He was then transferred to Secunderabad, where the Osmania University Medical School is located. He discovered the presence of the malarial parasite within the *Anopheles* mosquito and went on to trace the means of transmission of avian malaria.

In 1899 he resigned from the IMS and joined the infant Liverpool School of Tropical Medicine. In Sierra Leone he completed his work on the transmission of human malaria, and in 1902 was awarded the Nobel Prize in Physiology or medicine for his work on the disease. He was called up in 1914. As well as being consultant physician to Indian troops stationed in England he went to Egypt to investigate dysentery, ending the war working for the War Office on the coordination of the treatment of men with malaria.

Quinine

The bark of the cinchona tree is the only known natural source of quinine. The medicinal properties of the cinchona tree were originally discovered by the Quechua Indians of Peru and Bolivia; later, the Jesuits were the first to bring the cinchona to Europe. Quinine was the first effective treatment for malaria caused by *Plasmodium falciparum*, appearing in therapeutics in the 17th century. It remained the antimalarial drug of choice until the 1940s, when it was replaced by other synthetic drugs. Since then, many effective antimalarials have been introduced, although quinine is still used to treat the disease in certain critical situations.

Leishmaniasis

Leishmaniasis is found ranging from rainforests in Central and South America to deserts in West Asia and the Middle East. It affects as many as 12 million people worldwide, with 1.5–2 million new cases each year. The visceral form of Leishmaniasis has an estimated incidence of 500,000 new cases and 60,000

deaths each year, with more than 90% of the world's cases occurring in India, Bangladesh, Nepal, Sudan and Brazil.

Lieutenant-General Sir William Boog Leishman (1865–1926) was Director-General of Army Medical Services from 1923 to 1926. He also helped to elucidate the life cycle of *Spirochaeta duttoni*, which causes African tick fever. In 1900 he became Assistant Professor of Pathology in the Royal Army Medical College. He described a method of staining blood for malaria and other parasites – a modification and simplification of the existing Romanowsky method using a compound of Methylene Blue and Eosin dissolved in methanol. This became known as Leishman's stain and is still in use today and is endorsed by the WHO.

With Almroth Wright, he helped develop an effective anti-typhoid vaccine. Later, between 1904 and 1909, he tested and improved the vaccine, leading to its widespread use. In 1901, Leishman identified oval bodies in smears taken from the spleen of a patient who had died from "dum-dum fever" found for the first time in India.

Captain Charles Donovan, working independently, confirmed the finding of what became known as Leishman-Donovan bodies in smears taken from patients in Madras, India. Sir Donald Ross proposed that Leishman-Donovan bodies were the intracellular stages of a new parasite, which he named *Leishmania donovani*. He was first to suggest the link with the disease kala-azar, and this was confirmed by Charles Bentley's discovery of *Leishmania donovani* in patients with kala-azar. The disease was a major problem for Allied troops fighting in Sicily during the Second World War.

Yellow Fever

Walter Reed (1851–1902) was the Army officer who helped defeat yellow fever, one of the great enemies of the late 19th century. After the Spanish-American War the Walter Reed Commission was set up in Cuba. A series of experiments was conducted to explore how yellow fever is transferred from individual to individual, and how the disease is spread within households.

The study was conducted in an experimental sanitary station in Cuba, where exposures and movements could be completely controlled. During the investigation, 12 non-immune persons underwent different exposures, including mosquitoes that had fed on yellow fever patients, blood from infected patients, and fomites belonging to infected patients.

Walter Reed later served on the typhoid commission.

Observational findings

- *Aedes aegypti* mosquitoes transferred the disease from an infected individual to a non-immune person, proving Carlos Finlay's mosquito hypothesis.
- At least 12 days were needed for the extrinsic incubation period in the mosquito before it could transmit the infection.
- Yellow fever can be transferred to a non-immune person from the blood of an infected individual taken during the first two days of the illness.
- A filterable agent was responsible for infection.
- The incubation period for humans ranged between two and six days, and yellow fever cannot be transmitted by fomites nor spread in a house without the presence of mosquitoes.
- The most significant conclusion was that the spread of yellow fever can be most effectually controlled by measures directed to the destruction of mosquitoes.

BLOOD TRANSFUSION: ITS ROLE IN CONFLICT

Dr Lionel (later Sir Lionel) Whitby recognised that blood is a perishable commodity, as potentially lethal as it is lifesaving, and had to be handled through special channels by competent trained personnel.

Effective Blood Transfusion

Throughout the 20th century, milestones in the advancement of blood transfusion were synchronised with the onset of military conflict around the world. This began with the new knowledge of matching different blood groups, and the use of an anticoagulant that facilitated indirect transfusion.

Prior to the First World War

In 1901 Landsteiner discovered the ABO blood groups. Transfusion was only possible using defibrinated blood. In 1914 Moss instigated direct donor-to-patient techniques using paraffin wax-coated tubing and bottles. Major Lawrence Bruce Robertson introduced a new syringe-cannula technique, which allowed direct donor-to-patient transfusion. While this was always dependent on a ready supply of donors close to the battlefield, it did save the lives of many casualties.

Anticoagulant-Facilitated Indirect Transfusion

In Belgium in 1914 Adolph Huston demonstrated that sodium citrate, in tolerable quantities, could anticoagulate blood for transfusion. The following year Luis Agote in Argentina and Richard Lewisjohn in the USA verified its use for this purpose.

Outbreak of the First World War

Blood transfusion was favoured by the American and the Canadian surgeons arriving at the Western Front. In 1918, Captain Oswald H Robertson MORC USA established the first bank of stored whole blood, which, if testing negative for syphilis, could be given quickly and safely in forward medical units. The beneficial effect in combating blood loss in major trauma was soon recognised and adopted by British and French surgeons.

Spanish Civil War (1937–1939)

Conflict on the Iberian Peninsula gave rise to a fresh approach to blood transfusion, hastened by the threat of large numbers of civilian and military casualties. This resulted in a major initiative to increase the number of blood donors and to establish large-scale blood banks to ensure supplies.

Canadian Norman Bethune, whose WW1 experience taught him the importance of helping the wounded quickly, set up a blood bank close to the front lines and organised a mobile blood-transfusion service, the first of its kind.

Jorda added glucose to the citrate anticoagulant for blood collection, thus improving the viability of transfused red cells and increasing the benefits of transfusion. The subsequent publication of the effectiveness of transfusion, by army surgeons, resulted in its introduction to civilian medical practice.

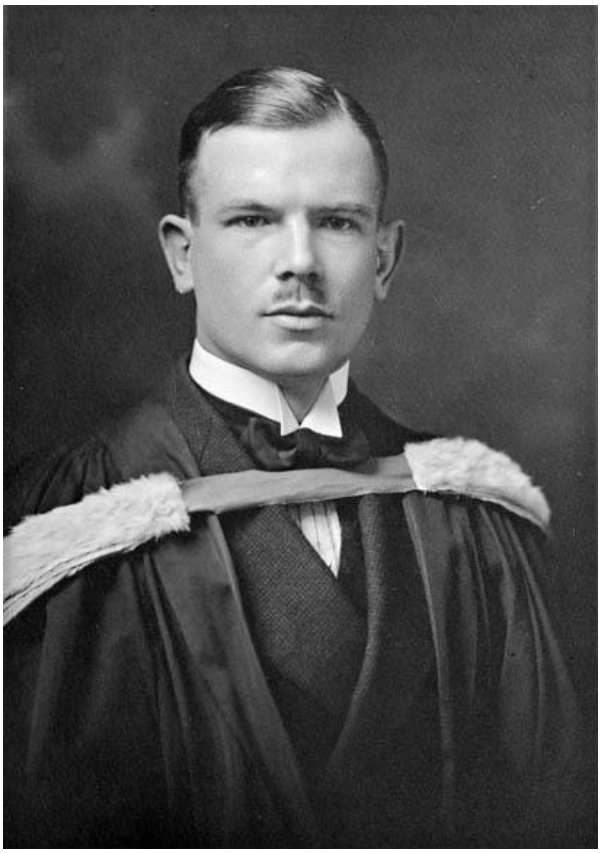
Onset of the Second World War

Prior to the outbreak of the Second World War, the organisation of blood transfusion services was haphazard in the UK with a few exceptions (eg Lane in London). In 1938 the War Department decided

Sir Lionel Whitby

Dr Charles R Drew

Dr Lawrence Bruce Robertson



Dr Henry Norman Bathune

Dr Luis Agote

Dr Richard Lewisohn

how blood transfusion support would be provided to military hospitals in war. In 1939 the Army Blood Transfusion Service was established, and the Army Blood Supply Depot (ABSD) was opened, commanded by Colonel L E H Whitby RAMC, the first military transfusion service in the world.

Army Blood Transfusion Service

The Army Blood Transfusion Service (ABTS) was organised on three levels:

- The Army Blood Supply Depot (ABSD) producing all wet and dried products, crystalloids, grouping sera, blood collecting and administering blood equipment. Provided training in all areas
- Base Transfusion Units, which were chiefly concerned with distribution. In each theatre of operations, five were deployed
- Field Transfusion Units, which worked in forward areas

The War Legacy

During the period September 1939 to May 1945 the Plasma and Blood Bank balance was 756,046 units, which was a testament to the care and competence with which the British handled blood:

- Accidents where kept to a minimum
- No single case of incorrectly typed blood was recorded

This led to the establishment of the National Blood Transfusion Service in all regions plus Plasma Product plants at Elstree and Chelsea.

Freeze Dried Plasma

Early research at the Lister Institute UK saw the development of techniques for storage of plasma for transfusion, stable in hot climates. This resulted in:

- a massive demand for plasma supplies to treat military and civilian casualties
- establishment of freeze-drying plants at the ABSD
- Edwin Cohn, in 1944, describing the ethanol separation and purification of plasma.

Acid Citrate Dextrose

Acid Citrate Dextrose (ACD) solution was introduced in 1943 by J F Loutit and Patrick L Mollison. It reduced the volume of anticoagulant, allowing a greater volume of blood to be given and permitting longer-term storage.

Dr Charles R Drew

Dr Charles R Drew, surgeon and researcher, developed techniques for preserving plasma. The first African American to receive a Doctor of Science degree, Drew proved that plasma could be stored significantly longer than whole blood. He supervised the 'Blood for Britain' programme, which met the desperate need for blood to treat those wounded during the Blitz. To encourage donation, Drew first devised the use of bloodmobiles, trucks with refrigerators serving as donation centres.

Emerging trends in transfusion services in conflict

Evidence-based recommendations have emerged to help guide war surgeons to rationalise transfusion in trauma patients with bleeding. One such recommendation is that Forward Transfusion Services should be fully mobile with integral transportation and communication systems.

Insta Blood Packs, extensively used by the Israel army, are packets of freeze-dried blood carried by soldiers as a part of their mandatory personal kit. A soldier's blood is frozen in laboratory conditions and the ice crystals removed, leaving only the blood component. The use of new additive solutions has increased the shelf-life of RBCs to more than three months, enabling blood and its derivatives to be transported to the most difficult of terrains

Transfusion experiences from the Gulf War have shown that installation of apheresis technology in peripheral hospitals has contributed significantly in bringing down the mortality and morbidity in field trauma cases.

The use of glycerolised frozen packed RBCs is a newer modality of long-term blood storage. RBCs processed in this manner and subsequently frozen and stored up to 10 years have shown sufficient post-storage yield and transfusion survival. Thawing and deglycerolisation by reincorporating the red cells into their native plasma as whole blood, or into any media adjusted to fit the exact recipient requirements, have revolutionised the handling of red cells stored for years. During the Gulf War an attempt was made to use frozen RBCs based on centrifugal RBC washing.

Extended supply lines are a major challenge for military logisticians, especially for blood components that are all sourced from NHS Blood and Transplant. They are packed by the blood supply element of the Centre of Defence Pathology and flown to the overseas military hospital. Providing blood at the times of national emergencies and war-like scenarios is not only a challenge to the transfusion service but also a time to showcase the efficiency and commitment of the transfusion services in the service of the nation.

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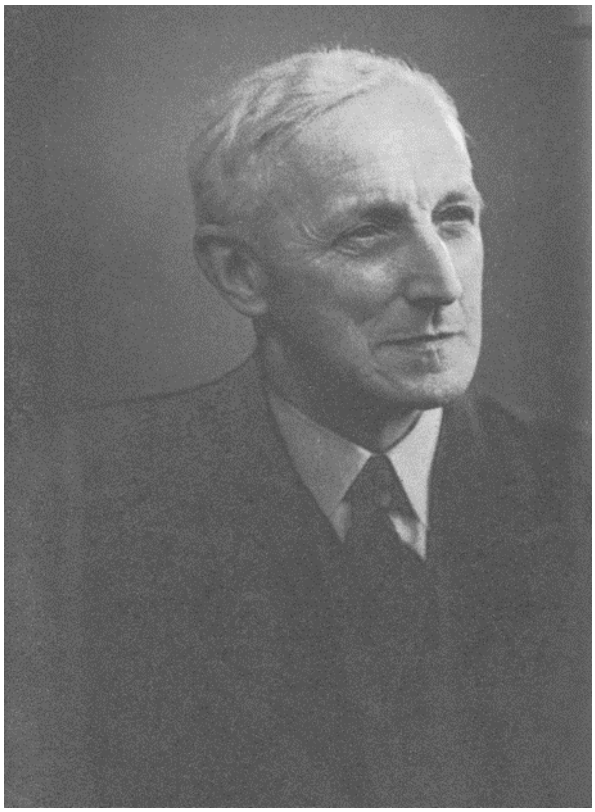

Albert Norman MBE

In the early years of the 20th century, Albert Norman developed the idea put forward by others of forming an association of laboratory assistants, and he began this daunting task by contacting, by postcard, as many of his colleagues as possible around the country – no mean feat considering the limited means of communication in 1911. The results of his efforts saw the birth in early 1912 of the Pathological and Bacteriological Laboratory Assistant's Association, an organisation he served in various roles right up to his death in 1964. During his laboratory career, Albert Norman was awarded an MBE and became the first recipient of the Sims Woodhead Medal.

Institute of Biomedical Science
12 Coldbath Square
London
EC1R 5HL

T: 020 7713 0214
E: mail@ibms.org
W: www.ibms.org