Proliferation

Prior to the early 20th Century the majority of casualties were not due to hostilities but suffering illness or death from disease often as the result of poor hygiene or debilitating parasitic infestation. As each of these were conquered the efforts turned to the combating the effects of blood loss.

1858 Royal Sanitary Commission

As a result of a glaring failure of organisation in the Army Medical Department, a Royal Commission was convened.

- Parkes served on the Commission, which included Florence Nightingale, to investigate the health of troops.
- The establishment of a Royal Army Medical School 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
- Parkes became the first Professor of Military Hygiene
- After three years the Army Medical School moved to the 1000 bedded Royal Victoria Hospital at Birley near Stockport.

South African War 1899-1902

The main killer in the war was again not the enemy but disease; 8,000 British soldiers were killed in action whilst, 14,000 died of disease (8,000 from Typhoid: 74,000 were treated). The advice of the new Hygiene Officer 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.

Lesson From The South African War

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.

Pure Drinking Water

Colonel Wilfred 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 WWI in keeping Allied forces largely free from water borne diseases. Dr (Later Colonel) Sims Woodhead introduced chlorination of water in bowser. The solution was filtered through sand in order to provide a portable method of purifying drinking water. It was particularly beneficial during WWI in keeping Allied forces largely free from water borne diseases. Dr (Later Colonel) Sims Woodhead introduced chlorination of water in bowser. The solution was filtered through sand in order to provide a portable method of purifying drinking water. It was particularly beneficial during WWI in keeping Allied forces largely free from water borne diseases. Dr (Later Colonel) Sims Woodhead introduced chlorination of water in bowser. The solution was filtered through sand in order to provide a portable method of purifying drinking water. It was particularly beneficial during WWI in keeping Allied forces largely free from water borne diseases. Dr (Later Colonel) Sims Woodhead introduced chlorination of water in bowser. The solution was filtered through sand in order to provide a portable method of purifying drinking water. It was particularly beneficial during WWI in keeping Allied forces largely free from water borne diseases.

Health & Fitness Of Recruits

- Great concern was raised over 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 given to raising the nation's health

Antibacterial revolution

- In the decade from 1935-1945, a new class of medicines capable of controlling bacterial infections launched a therapeutic revolution that continues today. It began in the mid-1930’s with the use of sulfonamides
- Penicillin was first used to great effect in the North Africa campaign
- Both carried the main therapeutic burden in both military and civilian medicine

Preventive Medicine

- Cholera
- Typhoid
- Sleeping sickness
- Kala-azar
- Undulant Fever
- Malaria
- Yellow Fever
- Syphilis
- Typhoid

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Outbreak of World War I

Between 1914–1918 Canadian Army Major Lawrence Bruce Robertson introduced a new syringe-cannula technique for performing direct donor to patient transfusion. Unmatched blood being the norm, many casualties died. Blood transfusion was pioneered by the Americans and the Canadian surgeon serving at the Western Front, Capt. Oswald H. Robertson. Robertson instigated direct donor to patient techniques, using paraffin wax coated tubing and bottles. This was always dependent on a ready supply of donors close to the battlefield.

The Spanish Civil War 1937–1939

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 Jorda added glucose to the Citrate anticoagulant for the first of its kind. He set up a blood transfusion service, and organised a mobile bank close to the front lines quickly. He set up a blood bank, issuing blood and grouping sera, wet and dried products. Lister Institute UK developed techniques for storage of plasma for transfusion, stable in hot climates.

Principles of Blood Transfusion

In 1901 Landsteiner discovered the ABO blood groups. Blood transfusion were synchronised with the onset of military conflict around the world. Beginning with the new knowledge of matching different blood groups and the use of an anticoagulant that facilitated indirect transfusion.

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. Beginning 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 1895, Insinger discovered the AB blood group. Transfusion was only possible using defibrinated blood. In 1914, Major Lawrence Bruce Robertson, introduced a new syringe-cannula technique, which allowed directed donor to patient transfusion.

Anticoagulants Facilitated Indirect Transfusion

In Belgium in 1918, 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.

Winter recognized that blood is a perishable commodity, as potentially lethal as it is life saving and had to be handled through special channels by competent trained personnel.

Acid Citrate Dextrose (ACD) Solution

This was introduced in 1945 by J.P. Louis and Patrick L. Mollison. It reduced the volume of anticoagulant, allowing greater volume of blood to be given and permitting longer term storage.

The War Legacy

During the period September 1939 to May 1945 the Plasma and Blood Bank balance was 756,045 units. Due to the care and competence with which the British handled blood.

- Accidents where kept to a minimum
- No single case of incorrectly typed blood recorded
- Led to the establishment of the National Blood Transfusion Service in all regions plus Plasma Product plants at Eltham and Chelsea.

Late 50’s Introduction of Plastics

- Avoidance of breakage and waste
- Integral blood taking set
- Disposable blood giving sets
- Start of each component production
Typhoid Vaccine

At the BACM, St Helier he began his life’s work on immunity
Typhoid Fever had a death rate of 10-30% at that time
1884 Courth, Pfeiffer, Kielie & Widal had shown that patients who recovered from typhoid had antibodies in their serum which agglutinated the typhoid bacteria in vitro. The Widal Test was born
He tested the effect of injection with heat killed typhoid culture on himself and ten soldiers
He produced antibodies and immunity to typhoid
Despite bad side effects he then inoculated 2550 British soldiers going to India where typhoid was common. It appeared very few developed the disease
1896 The War Office ordered inoculate soldiers heading for the Rose War but limiting it to volunteers only. Of the 448,000 deplored only 14,000 were inoculated, anecdotal evidence showed its worth where only half of the inoculated men developed the disease, however, record keeping during the war was poor. Wright had a deep aversion to statistics
This was stated 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 St Helier, Leasburg, who was appointed as his successor and continued the work, modified the production method and improved the inoculum
1902 Wright moved on to St Mary’s Hospital Medical School as Professor of Pathology and set up a vaccination and inoculation clinic

A Different Kind of Battlefield

- Flanders Fields were replete, well manured and horses were in common use around the battlefields. Soldiers living in the trenches became contaminated with crushed faeces and bacterial spores
- Projectile wounds caused by bombs, shell fragments and high velocity bullets carried in filthy mud and fragments of soldier clothing
- Most damage was caused by Cholera, dysentery, pleurisy, typhoid fever, Choloremia tetani causing tetanus
- Typhoid Fever had a death rate of 10-30% at that time
- Treatment by vaccine therapy.
- Treatment by physiological methods such as opening wounds to allow pus to escape
- Treatment by antiseptics

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 saved. Would this have been achieved at all without Wright’s passion and determination?

Sir Almroth Edward Wright (1861-1947)
Britain’s first Academic Immunologist
A pioneer of Medical Laboratory Science
He was qualified in both Modern Languages and Medicine and commenced his professional life as a Typhologist. After working in Europe and Australia he returned to London. In 1889 he worked at the cropping research laboratories in the Royal College of Physicians and Surgeons where his successor Dr Leonard Simms Woodhead
He was appointed as his successor, continued the work, modified the production method and improved the inoculum
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Typhoid Inoculation
- Still convinced of the value of anti-typhoid vaccine Wright started a production unit in partnership with Parke Davis and arranged for a second study on British troops stationed in India
- The 1884-1891 work was carried forward and improved on by Leasburg and Leishman
- He was assisted at varying times by Dr. William M. Colebrook, Mathews, Fleming and others

1897 and ended in January 1898 affecting nearly 2000 people, 143 of whom died
- Inoculated troops against typhoid and petitioned Lord Kitchener
- He was appointed in 1892 as a civilian which led to 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
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Therapeutic Methods
Wright proposed three distinct therapeutic measures when dealing with wounds and tetanus. “I am convinced that one of the great diseases of war has been the fear of amputation. The practice of this disease has been to prevent it. It is well known that the arm or leg amputated is not a worse disease than a limb septic.

Tetanus Antiserum
1897 BJR and Khakhi demonstrated that sera from another animal immune to a disease could be used to treat other animals (cattle, rabbits, guinea pigs) with the disease.
- Produced antiserum that could be used to treat others effectively
- An antiserum was developed for tetanus and diptheria in 1930
Tropical Diseases

Sir Ronald Ross
(1857-1932)

Malaria life cycle, Nobel Laureate

Graduated from St Bartholomew’s Hospital Medical School 1881 and joined the Madras branch of the Indian Medical Service (IMS). He studied malaria between 1881 and 1889 at the Presidency General Hospital, Calcutta. In 1885, Ross was posted as the Acting Garrison Surgeon at Bangalore during which time he noticed the possibility of controlling mosquitoes by controlling their access to water. In 1897, Ross was posted in Seringapatam 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. It was the antimalarial drug of choice until the 1940s, when other synthetic drugs replaced it. Since then, many effective antimalarials have been introduced, although quinine is still used to treat the disease in certain clinical situations.

Lieutenant-General Sir William Boog Leishman
(1865-1926)

Leishman Stain, Leishmaniasis

Walter Reed
(1851-1902)

After the Spanish-American War the Walter Reed Commission set up in Cuba a series of experiments to explore how yellow fever is transmitted from individual to individual and how the disease is spread within households.

The study was conducted in an experimental sanitary station in Cuba, where exposure 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 feathers belonging to infected patients.

Leishman-Donovan bodies - spleen smear Leishman stain

What is 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, more than 90 percent of the world’s cases of are in India, Bangladesh, Nepal, Sudan, and Brazil.
Malta Fever

Malta fever

- After a brief spell in general practice, Bruce started 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 tuberculosis bacillus, Bruce decided to investigate Malta fever, which annually hospitalized around a hundred soldiers of the British garrison for an average of three months. Malta fever was responsible for 130,000 days of disease each year.
- Following Koch’s publication 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 goat’s milk was the disseminating vehicle of the disease.
- When goat’s milk was eliminated from the diet of Malta fever patients, the disease disappeared. This disease is now called “Malta fever” or other names such as “Mediterranean Fever” or “undulant fever” are no longer used.

Major General Sir David Bruce (1855-1931)

David Bruce was well known for his study of Malta fever (brucellosis) and sleeping sickness (trypanosomiasis). Born in Australia and moved to Scotland aged 5 when his family returned home. He graduated from Edinburgh Medical School. He was a great physician and a pioneer of veterinary microbiology.

Into Africa

- 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 Umbombo 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 Umbombo, 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 cattle, mules, and camels.
- A similar disease known as Surra had been described in West Africa.
- In 1897 a surgeon, Timothy Lewis of the Royal Army Medical Corps, discovered a trypanosome in a rat whilst working in Bombay.
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Back to Africa

Captain David and Mary Bruce returned to South Africa to investigate the outbreak of enteric fever during the Boer War. They were present at the siege of Ladysmith where Bruce was commissioned a Field Hospital. He returned home 1901.

And Again

- 1908, Bruce rejoined the commission, 1911, appointed Director of the third commission and went to Nyasaland. Trypanosoma gambiense and the tsetse fly Glossina palpalis the vector.

Current Nomenclature

Trypanosoma gambiense found in the West Africa
Trypanosoma chagasi found in East Africa
Trypanosoma brucei found in Subsaharan Africa

What is Trypanosomiasis?

Human African trypanosomiasis, sleeping sickness, African leishmaniasis or Congolese trypanosomiasis is estimated that 50,000 to 70,000 people are currently infected, the number 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 16,000 cases reported in 2009 according to WHO figures which represents a huge decrease from the estimated 500,000 new cases in 1958. The disease has been recorded as occurring in 35 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.