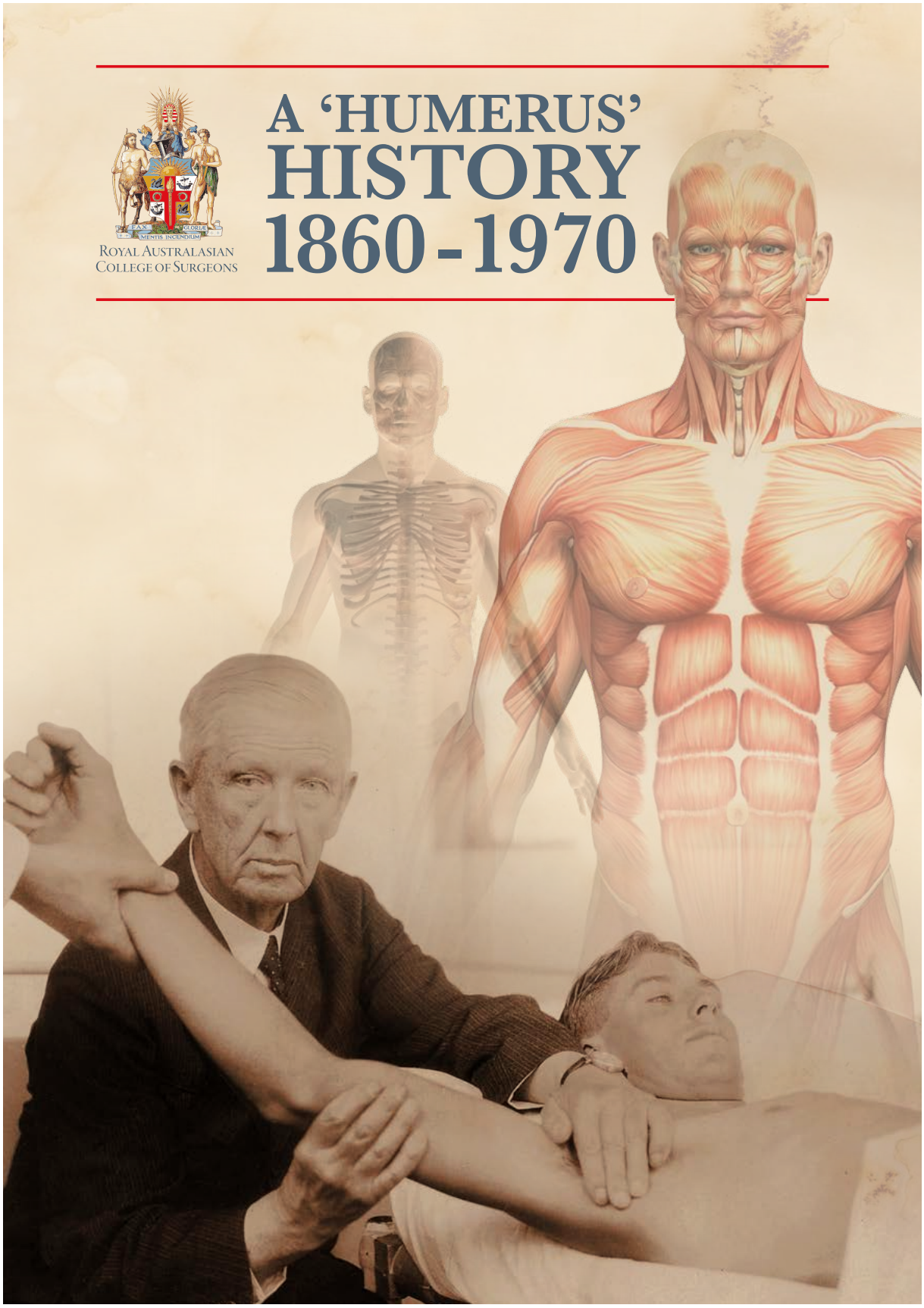

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Job No: RAC15

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A 'HUMERUS' HISTORY: 1860-1970

INVENTIONS AND DISCOVERIES AFFECTING THE DEVELOPMENT ORTHOPAEDIC SURGERY (1860-1970)

1866 - 1891	Hugh Owen Thomas' innovations include: ***Thomas collar*** - to treat tuberculosis of the cervical spine ***Thomas manoeuvre*** - for investigation for fracture of the hip joint. Early diagnosis meant that the joint was less likely to ankylose ***Thomas wrench*** - for reducing fractures ***Osteoclast*** - to break and reset bones ***Thomas test***- to rule out hip flexion contracture and psoas syndrome ***Thomas heel*** – part of a shoe for children, used to bring the foot into varus deformity/prevent depression of the head of the ankle bone
1875	Hugh Owen Thomas first describes the ***Thomas splint*** in: *Diseases of the hip, knee and ankle joints with their deformities, treated by a new and efficient method*
1888 - 1895	Robert Jones works at the Manchester Ship Canal. He organises the world's first casualty service for workers, setting up a series of field hospitals along the canal
1891	German Professor Themistocles Glück makes one of the earliest attempts at hip replacement He uses ivory to replace femoral heads of patients whose hip joints had been destroyed by tuberculosis
1895	Wilhelm Röntgen discovers X-rays
1896	Robert Jones and Thurston Holland take the first X-ray in Britain and locate a bullet in a boy's wrist
1902	Robert Jones describes the ***Jones fracture*** - a fracture of the fifth metatarsal caused by cross-strain rather than direct trauma
1924	Robert Hamilton Russell describes a system of balanced traction for the management of femoral fractures in *Fractures of the Femur: A clinical study*
1928	Alexander Fleming discovers penicillin
1932	First discectomy surgery was performed by Mixter and Barr
1940	At the Columbia Hospital in South Carolina, Austin T Moore performs the first metallic hip replacement surgery. The original prosthesis he designed was a proximal femoral replacement, with a large fixed head made of the cobalt-chrome alloy. (Vitallium)
1940s	Gerhard Küntscher invents the ***Küntscher nail***. This was '…an intramedullary rod to maintain alignment of femoral shaft fractures…'
1951	Walldius Shiers creates the ***Walldius*** hinge joint for knee joint replacement. Initially made from acrylic, in 1958 it was manufactured from cobalt and chrome. Unfortunately, both versions of the joint were prone to loosening, so were not successful
1954	The ***Ilizarov Apparatus*** is first successfully used. Designed by Gavril Abramovich Ilizarov of the USSR, this device was '…an external fixator device comprising two linked rings securing tensioned fine wires transfixing the bone like the spokes of a bicycle.' It enabled accurate realignment of long bone fractures and was also used to secure healing of ununited fractures and lengthening of limbs
1958	Masaki Watanabe from the University of Tokyo develops the first arthroscope to investigate knee joints
1961	Alfred Sabin develops an oral polio vaccine. The inactivated (injectable) polio vaccine had been discovered by Jonas Salk in 1955
1961	John Charnley perfects his ***Low Friction Arthroscopy Concept*** and uses Teflon (PTFE) for the socket of a total hip replacement. This was unsuccessful because teflon was not particularly durable and it also reacted with the soft tissues
1962	Charnley uses High Molecular Weight Polythene (HMWP) for the socket of a total hip replacement. In 1967 he declares that HMWP is a safe and durable material for the procedure
1960s	Canadian, Frank Gunston pioneers total knee replacements. He designs an unhinged knee that replaced the medial and lateral sides of the joint with separate condylar components

Royal Australasian College of Surgeons

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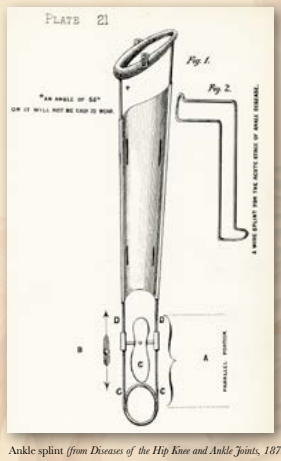
A 'HUMERUS' HISTORY: 1860-1970

HUGH OWEN THOMAS (1834-1891)

Hugh Owen Thomas c1880s *(Wellcome)*



Ankle splint *(from Diseases of the Hip Knee and Ankle Joints, 1875)*

Welshman Hugh Owen Thomas came from a family with a long tradition of bone setting. He trained with his uncle, Dr Owen Thomas at St Asaph in North Wales and studied medicine at Edinburgh University and University College, London.

His reading as a student included the works of the 17th century physician, Thomas Sydenham who postulated …*that illnesses were best treated by working with nature rather than against her.* Thomas was also influenced by Sir Benjamin Brodie's idea of reducing inflammation by …*keeping the limb in a state of perfect quietude*; and John Hughes Bennett who believed in the stimulating effects of fresh air.

In 1857, he obtained his MRCS and studied in France, before returning to Liverpool. Working briefly with his father, Thomas then set up a practice in a poorer part of town – at 11 Nelson Place, Liverpool. His patients included children afflicted by tuberculosis of the spine and joints, rickets and polio; and injured dockworkers and seafarers, many with long-standing injuries.

Thomas felt that fresh air was important for children and promoted the idea of improvised soap box beds to be chained to the railings outside their homes. He advocated rest that was 'enforced, uninterrupted and prolonged' for the treatment of fractures and tuberculosis. He was so insistent on immobilisation that he was known to personally change a patient's socks (every six weeks!), thus ensuring the patient did not move. With the aid of a blacksmith and saddler, he created ingeniously designed splints for his patients. These were simple but effective devices, crafted so that even the poorest patient could afford them. The most famous of these was to become known as the *Thomas splint*.

This was first used in 1865 to treat diseases of the knee such as tuberculosis of the knee joint. As it had the ability to stabilise fractures and prevent infection, it was later used to manage fractures of the lower limb.

Thomas was an eccentric character who always dressed in a frock coat buttoned up to his neck and a glazed peak cap. He was much loved by the poor and at his free clinic on Sundays, patients would besiege his waiting room and fill the surrounding streets with their conveyances. However, his acerbic personality and a terse writing style did not endear him to his peers. Consequently, his innovative ideas were not readily adopted by the medical fraternity. It was left to his more genial nephew, Robert Jones to champion his views.

Thomas's contribution to British orthopaedics was prodigious. Apart from the numerous tests and inventions listed on the timeline, his theories about treating fractures and disease with rest and immobilisation still have credence today.

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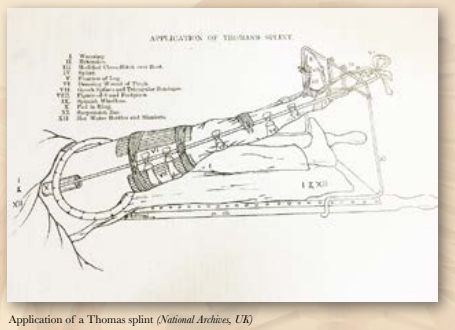
A 'HUMERUS' HISTORY: 1860-1970

(SIR) ROBERT JONES (1857-1933)

Sir Robert Jones c1900 *(Wellcome)*



Application of a Thomas splint *(National Archives, UK)*

When Robert Jones was 16, he went to live with his uncle Hugh Owen Thomas and became his pupil. Imbued with Thomas' innovative ideas, he studied medicine at Liverpool University and obtained his FRCS (Edin.) in 1889. He worked as a surgeon at the Stanley Hospital in 1887, then became surgeon to the Manchester Ship Canal project. During the next five years, he established an accident service to deal with the large number of injured workers. A contemporary wrote that: *...he had learnt the elements of organisation, of supervision and the treatment of desperate casualties under primitive conditions.*

Jones was intrigued by Röntgen's discovery of x-rays and purchased a rudimentary x-ray machine from Germany. Working with Thurston Holland, he used it to locate a bullet in a boy's wrist and their findings were published in the Lancet in 1896. In 1902 Jones sustained an injury while dancing. X-rays revealed that it was a fracture between the base and middle part of the 5th metatarsal bone of the foot. In the *Annals of Surgery* of the same year and using evidence from six case studies, Jones described the eponymously named *Jones fracture*.

In the late 19th century, fractures were usually dealt with by general surgeons and diseases of the joints such as tuberculosis, by orthopaedic surgeons. Thomas, Jones and other surgeons gradually reversed this trend and became involved in fracture management.

During the World War 1, Jones was a consultant orthopaedic surgeon to the British army and was increasingly concerned with the poor management of fractures. In a letter to the *British Medical Journal* (December,1914), he advocated the use of the *Thomas splint* in fractures of the middle and lower thirds of the femur, knee and upper tibia. This suggestion was adopted by the army in 1916, reducing mortality from these fractures from approximately 85% to 20%. When Jones was promoted to Director of Military Orthopaedics, he established a series of military orthopaedic hospitals and wrote:

If I was made dictator, I would have an accident centre in each large city, where cases could be treated properly and for as long as necessary.

Jones also helped establish systems where soldiers were rehabilitated and integrated into the community.

Since meeting Agnes Hunt in 1889, Jones had been interested in the care of crippled children and in 1919, with Robert Girdlestone, he wrote an influential paper outlining a national scheme for the cure of crippled children. In 1921, he collaborated with Agnes Hunt to open the *Robert Jones and Agnes Hunt Orthopaedic Hospital* in Owestry.

A man with a social conscience, innovative but also advocating conservative measures such as rest and immobilisation of limbs when necessary, Robert Jones had a profound influence on the development of orthopaedic surgery.

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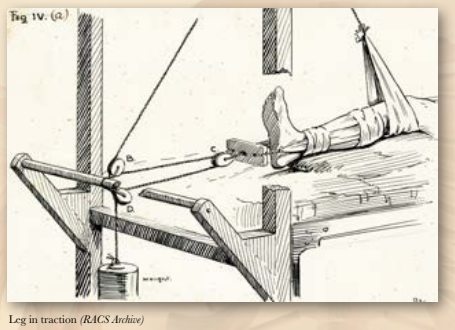
A 'HUMERUS' HISTORY: 1860-1970

ROBERT HAMILTON RUSSELL (1860-1933)

c1890s *(RACS Archive)*



Leg in traction *(RACS Archive)*

Born in Farningham, Kent, Russell studied medicine at King's College, London and obtained his MRCS LRCP in 1882. A student under Lister whom he admired, Lister's recommendation helped Russell get his first position – as a House surgeon at the Shropshire County Hospital in Shrewsbury. In 1889, he obtained his FRCS and he moved to Melbourne in the same year.

Starting work as a General Practitioner in Hawthorn, Russell met the Grainger family and became friendly with the pianist and composer, Percy Grainger. In 1892, he was appointed as an honorary surgeon at the Children's Hospital. A general surgeon with a variety of interests, in 1899 at the Intercolonial Medical Conference in Brisbane, he read a paper on the *Aetiology and treatment of inguinal hernia in the young.*

Around the same time, he became interested in fractures and devised the Hamilton Russell suspension for fractured femur in children. Traction of the suspended limb was created by using weights and splinting was not used. These ideas culminated in the paper: *Fracture of the Femur: A Clinical Study*, published in the British Journal of Surgery (1924). Russell was also opposed to the concept of passive movement - the protective contraction of the muscle in response to pain - in fracture management. Russell showed that although muscle spasm passively checked movement of the joint, it led to movement at the fracture site.

Russell joined the staff of the Alfred Hospital in 1901 and was also a demonstrator in anatomy at the Melbourne Medical School. At the Alfred, he was renowned as a teacher and prior to World War 1, medical students would visit the Alfred for extra tuition with him. Commenting on his prowess as a teacher, (Sir) William Upjohn stated: *He stimulated us to think not to copy.*

In 1914 Russell was in England when war broke out, so he joined the British Expeditionary Force and served at Lady Dudley's Hospital in France. After the war, Russell was instrumental in forming the Victorian Association of Surgeons (1920) and was one of the most influential founders of the RACS. From 1929, he was Director-General of RACS and then became its first Censor-in-Chief.

Russell's collected papers were published in 1923 and included his work on urethral stricture and two ground-breaking operations carried out at the Alfred – the removal of a shawl pin from the lower lobe of the lung by thoracotomy (1903); and the complete closure of the abdomen following evacuation of a hydatid cyst (1907).

He was described by Upjohn as:

…a tall man of striking, somewhat Mephistophelian appearance, full of boyish spirits and impish fun and delighting in verbal warfare…

In later life Hamilton Russell was plagued by osteoarthritis of both hips. He died in 1933 when his car crashed into a lamp post, but his legacy lives on.

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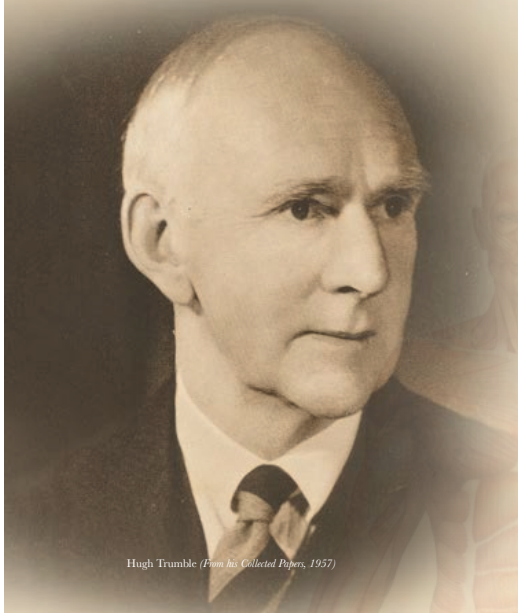
A 'HUMERUS' HISTORY: 1860-1970

HUGH COMPSON TRUMBLE (1894-1962)



Hugh Trumble *(From his Collected Papers, 1957)*

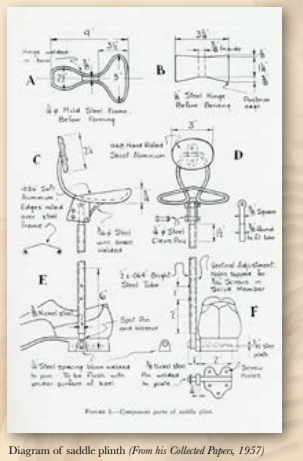


Diagram of saddle plinth *(From his Collected Papers, 1957)*

Born at Nhill, Victoria, Hugh Trumble came from a family of cricketers, and his uncle Hugh played test cricket for Australia. When his family moved to Melbourne, he was educated at Brighton Grammar School and was dux in 1911. He started his medical course at Melbourne University, graduating with an MBBS in 1916. Instead of completing a hospital residency, Trumble joined the Australian Army Medical Corps and was posted to France, mostly serving as Medical Officer to the 14th Battalion. He was wounded twice and awarded the Military Cross in 1918.

After the war, Trumble travelled on the continent with his friend Hugh Cairns who thought he was:

…extraordinarily brainy in a practical way.

After obtaining his Fellowship of the English College, he returned to Melbourne in 1922. Appointed as a general surgeon, Trumble had wide interests including orthopaedics and thoracic surgery. In the 1920s, he treated patients with pulmonary and bone tuberculosis and in 1926 and 1928, he wrote papers about tuberculosis of the spine.

As he was dissatisfied with the operation for fusing tubercular hip joints, he devised a successful method for putting a bone strut between the ischial tuberosity and the shaft of the femur. From childhood, Trumble was an inventor and like Hugh Owen Thomas, created functional beds – including plastic beds reinforced with scrim or hessian - and splints. When managing tuberculosis of the hip, he felt that:

…it was unwise to resort to operative measures while the inflammatory process was still active.

Diagram of saddle plinth *(From his Collected Papers, 1957)*

His solution was to invent *…an ingenious saddle appliance to relieve the lower limb from the strain of weight bearing.* He also crafted many of his own surgical instruments, often fashioned from engineering tools. Hospital staff then had to persuade him that his tools should be electro-plated.

In 1934, he moved to Neurosurgery and with his brother-in-law, established the first neurosurgical unit at the Alfred Hospital and was one of the founders of the Society of Australian Neurosurgeons (1940). His inventiveness and extensive scientific interests culminated in the *Collected Papers of Hugh Trumble*, published by the Alfred Hospital in 1957.

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A 'HUMERUS' HISTORY: 1860-1970

MOVING FORWARD

Reduction external fixation operation on the femur *(Wikimedia Commons)*

By the early 20th century, fuelled by the work of practitioners like Hugh Owen Thomas, Sir Robert Jones, Reginald Watson-Jones and others, the definition of orthopaedic surgery became broader – joint disease was still treated but fractures and musculoskeletal issues were now part of the orthopaedic remit. From the 1890s, X-rays were increasingly used in the diagnosis and treatment of fractures; and new drugs and vaccines meant that by the 1960s, there were fewer cases of tuberculosis and polio.

Today, the orthopaedic specialty has changed markedly – there are sub-specialities such hand surgery within the specialty; and there are more women. Our first female FRACS in orthopaedics was Pearl Macleod (1954) but it took more than 30 years for other women to take up the orthopaedic baton.

Orthopaedics is an area primed with technical advancements such as knee replacements which are longer lasting, better fitting and can be cement-less. There are also innovations in diagnostic and surgical imaging, minimally invasive surgery and tissue-guided surgery which uses the patient's own anatomy to fit an implant, robotic surgery and the use of stem cells to promote healing. Orthopaedic surgery has evolved through a history of continuous innovation and this trend continues today.

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