## ***BOTM: August 2006***

### Hip Implant

**Legend:** Hip Implant. Pictured here is a hip implant surrounded by model bone. In addition, strain gauges are seen which assist in experimentally measuring hip implant movement

within the bone cement and juxtaposed bone.

The earliest recorded attempts at hip replacement (Gluck T, 1891), which were carried out in Germany, used ivory to replace the femoral head (the ball on top of the thighbone). Use of artificial hips became more widespread in the 1930s; the artificial joints were made of steel or chrome. They were considered to be better than arthritis but had a number of drawbacks. The main complications of hip arthroplasty (replacement) are wear of the polyethylene liner, loosening of the joint components, and infection of the joint. These methods of failure require removing the original compnents and insertion of new components (known as revision operations) which are significant undertakings. Attempts to use teflon produced joints that caused osteolysis and wore out within two years. Before the advent of antibiotics, surgery on the joints carried a high risk of infection. Even with antibiotic treatments, infection is still a cause for some revision operations. Such infections are not necessarily caused at surgery; they can also be the result of bacteria entering the bloodstream during dental treatment.

The modern artificial joint owes much to the work of John Charnley at Wrightington Hospital; his work in the field of tribology resulted in a design that completely replaced the other designs by the 1970s. Charnley's design consisted of 3 parts (1) a metal (originally Stainless Steel) femoral component, (2) an Ultra high molecular weight polyethylene acetabular component, both of which were fixed to the bone using (3) special bone cement. The replacement joint, which was known as the Low Friction Arthroplasty, was lubricated with synovial fluid. The small femoral head (22.25mm) was chosen for it's decreased wear rate however has relatively poor stability (the larger the head of a replacement the less likely it is to dislocate, but the more wear debris produced due to the increased surface area). For over two decades, the Charnley Low Friction Arthroplasty design was the most used system in the world, far surpassing the other available options (like McKee and Ring).

In the last decade, several evolutionary improvements have been made in the *total hip replacement* procedure and prosthesis. A lot of development is occuring in the use of alternative bearings, such as ceramic (head) on polyethylene (cup), ceramic on ceramic and metal on metal. Ceramics have been used previously as they have better wear characteristics than poly, however poor manufacturing techniques lead to early failure (by fracturing). There has also been a move away from cemented arthroplasty to uncemented methods of fixation. The prosthesis is given a porous texture into which bone grows (ie Porocoat (tm), or ridges with hydroxyapatite). Surgeons still frequently use bone cement for

the femoral component, however, which has proven very successful after 35 years of clinical experience.

[Obtained in part from http://en.wikipedia.org/wiki/Hip_replacement - students/learners can click on this to read more]