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Orthopaedics in the next millennium

We are now 17 years into the 21st century and how far have we really moved on in orthopaedic surgery? The *Time* magazine 'operation of the century' in the year 2000 was the hip arthroplasty. Developed over a relatively short period of time, the efforts of Charnley, Harris, Muller and countless others have left a legacy of literally millions of patients whose lives have been transformed by orthopaedic surgeons. One of my old mentors used to refer to hip arthroplasty as a 'Christmas Card operation', by which he meant that, long after one had forgotten the patient, it was not uncommon to receive an unsolicited Christmas card with a short but personal note letting the surgeon know how the patient was doing often a decade or more after they had undergone their surgery.

The problem is that hip arthroplasty remains one of the only Christmas Card operations in orthopaedics. We have failed wholesale to provide robust and long-lasting treatments for a range of conditions. With the development of cellular biology and genome sequencing, we have a tremendous understanding of how cells survive and die, what the developmental biology of stem cell lines are and how musculoskeletal tissues develop. We have a much better grasp of the biomechanics and tribology of the musculoskeletal system than our forefathers. Despite these quantum leaps in understanding, we have yet to have an effective medical biological cure for osteoarthritis, we cannot really regenerate cartilage and implant it (although steps have been made), and we are yet to produce successfully a biologically compatible implant that doesn't inevitably loosen over time.

The feature article this month highlights the problems and solutions that are evolving rapidly in shoulder arthroplasty, and in particular the reverse arthroplasty. However, this really does serve to underline the complexity of the engineering and biomechanical problems. Although great strides have been made in improving outcomes, it does seem that for every challenge overcome, another one is looming on the horizon.

Nonetheless, there are many promising strands of research, and I find myself being an eternal optimist; every time I open a paper with a new angle or potential for biological intervention, I am struck by both the excitement of a novel discovery and the potential that the next big thing, successful biologics in orthopaedics, might be about to happen.

A number of real potentially game-changing papers have caught my eye in this issue. The excellent work from Denmark linking twin studies to arthroplasty registries gives us the opportunity potentially to explore genetic variation and outcomes in arthroplasty. Surely the first step in understanding the genetics behind osteoarthritis development, using this methodology the research team were able rather elegantly to explain the contribution of genetic and environmental factors to the incidence of hip and knee arthroplasty. It appears from their results that these are somewhat different.¹ This is research that is just crying out for a genome-wide association study (GWAS)-style supplementary investigation and may explain the epigenetics of large joint osteoarthritis. At the joint preservation end of the spectrum, in one of the most well thought out and carefully

conducted research programmes I have seen in recent years, the study team have investigated the potential joint-preserving effects of isothiocyanates and have gone as far as to establish that these compounds are not only available in broccoli, but have a direct impact on gene and protein expression and are able to penetrate the joint and be measured effectively in synovial fluid.²

The last decades since the advent of arthroplasty, and those since the discovery of the double helix, have not been idle in orthopaedics and musculoskeletal medicine. Our knowledge is now greater than it has ever been, and although we have yet to have another eureka moment such as that experienced by the fathers of hip arthroplasty, almost simultaneously in several countries on different continents, little by little we are moving the chess pieces for the next tremendous breakthrough. I'm not sure what *Time* magazine's operation of the 22nd century will be, or even if there will be a *Time* magazine by then, however, I am hopeful that some of the vast accumulated knowledge will translate into new treatments as successful, exciting and novel as hip and knee joint arthroplasty was in the 1950s and 1960s.

REFERENCES

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2. Davidson R, Gardner S, Jupp O, et al. Isothiocyanates are detected in human synovial fluid following broccoli consumption and can affect the tissues of the knee joint. *Sci Rep* 2017;7:3398.