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Usership of regenerative therapies: Age, ageing and anti-ageing in the global science and technology of knee cartilage repair

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ABSTRACT

The paper explores the relationship between the development of regenerative medicine and society's understanding of age and ageing, by focusing on the case of knee cartilage. Knee joints are susceptible to handicapping damage from debilitating disease and heavy physical activity. Wear and damage to joints have been held to be normal and to result in osteoarthritis, associated with old age. A range of different 'regenerative' approaches to knee cartilage repair are emerging internationally, amid challenges to conventional understandings of arthritis. Usership of these technologies is supported by a variety of claims inscribing a range of different profiles of users and market sectors. The paper shows the discursive linkages made by stakeholders between cartilage damage and subsequent osteoarthritis in medical texts, and maps a range of recent cartilage-related research, identifying key actors in the academic and commercial fields. Usership and market-building related to age and ageing are analysed through scientific agenda-setting claims, expectations, and innovation activities, demonstrating the imagined or claimed users of these technologies. The analysis points to a disparity between claims about elderly clientele for regenerative technologies and current younger patient participants in scientific work, which also has a gender dimension. A cautious note is sounded in considering the significance of anti-ageing medicine, claims about extension of the lifecourse, and 'human enhancement' through 'regeneration'. The analysis and argument raise the question of whether, in practice, the novel biosciences of bodily ageing and associated regenerative medicine technologies themselves might be inscribed with ageism.

1. Introduction

Like nostalgia, ageing isn't what it used to be. An emerging 'regenerative' medicine, demographic trends of the greying of society, and public policies concerning elderly people are increasingly being aligned in the discourse both of bio-scientists and many social scientists in approaching old age and ageing. Bioscientists worldwide are developing an array of technologies broadly conceived as 'Regenerative Medicine', which is becoming represented as 'anti-ageing' medicine in some quarters (for example, 'The World Anti-Aging Academy of Medicine; the first global entity in anti-aging and regenerative medicine' — http://www.waaam.org/). In this movement, the scientific investigation of biological ageing processes of cells and tissues of the human body becomes generalised into a mission of increasing longevity of the human lifespan itself. Taking a long-term historical perspective, disease and death as culturally constructed phenomena have increasingly become conceived as phenomena of old age, characterised by a normalisation of physical deterioration, of declining powers and physical and mental energies. This trend is paralleled by that conceived by epidemiologists as the 'rectangularisation of mortality', in which graphs of population survival statistics show that illness and death are progressively being pushed into the latest stages of the lifecourse. Similarly, age-defined disciplines such as gerontology tend to maintain a medicalised framing of older people as frail, rather than attending to their capabilities. However, even

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these depictions of old age epidemiology and medicine are being challenged by some visions of regenerative medicine.

The appearance of novel cellular and tissue-engineered biomedical innovations for a wide variety of physical medical conditions remains largely under society's radar, and thus their social significance remains unclear. At the same time the movements of 'anti-ageing medicine' are drawing on the promise of these technologies. It is necessary to improve the understanding of the current evolution of these radical social visions from a social science perspective informed by empirical study of different sciences and technologies and how they are, or are not, being deployed by interested actors globally to reconfigure notions, policies and practices of ageing. This paper aims to make a contribution to this endeavour. It does so by focusing upon a single, literally and socially hidden technology, which is being developed to help heal injuries to the human knee joint.

Knee joints are one of the points of the human body susceptible to handicapping damage from debilitating disease, over-use, excessive weight-bearing and the strains of physical and athletic activity. The articular cartilage (allowing the smooth rotation of the knee joint; it is said to be more slippery than ice on ice) is especially prone to damage. Unlike bone, cartilage does not repair itself. Wear and/or damage to joints has traditionally been taken in medical opinion to result in osteoarthritis, one of the most common medical conditions worldwide, and associated in much expert and nonexpert commentaries and imagery with old age, typically with sociomedical connotations of fate and inevitability. Apart from medication for pain control, prosthetic knee joint replacement is a widely used orthopaedic treatment (though not as successful as the equivalent hip prosthesis). 'Bad knees' are typically seen in the public imagination as a sign of old age. However, in recent decades the status of osteoarthritis as a natural accompaniment of old age or alternatively as a 'disease' is disputed in the medical, surgical and now biomedical professions [1]. In this context, there is a major international scientific effort to find 'regenerative' approaches to knee cartilage repair. These range from the more surgical to the more cell-based, including tissue-engineered and stem cell-based approaches. This effort can be seen in an emerging range of research activity and the increasing availability and promotion of proprietary innovative techniques. For example, patients deemed to suffer from diseases deemed to be 'degenerative' may be offered access to stem cell treatments, and several variations of a technique called 'Articular Chondrocyte Implantation' (ACI) are already available and quite widely taken up amongst select users. (Chondrocytes are cartilage cells.)

I use the concept of 'usership' in this paper, as elsewhere [2], to refer to the set of concepts, imaginings and expectations that are projected by researchers and developers of innovative technologies, and which can become embedded or 'scripted' [3] into technoscientific artefacts in the practices of actual use, thus performatively 'configuring the user' [4]. These processes of usership have a counterpart in the concept of markets and market-building in business-oriented innovation studies. Markets require users.

Given this background, the aims of this paper may be summarised as follows. In the context of the burgeoning array of sciences and technologies addressing the knee cartilage issue, the paper presents data illustrating these trends, discussing how the usership of actual and promissory medical technologies is developing and how users – patients, people with knee joint problems – are being framed in this technoscientific work, and how claims and expectations relating to age and ageing are being built around it. This techno-scientific and clinical work and its framing by stakeholders are analysed to reveal how users and potential users of the emerging cartilage repair field are configured as idealised individuals, populations and markets characterised in terms of concepts of age and ageing. Thus I ask which sectors of the potential user population have the massive worldwide focus on cartilage science and technology being geared toward, and in what ways does the emerging science of regenerative medicine formulate the age and 'ageing' of users in the cartilage case? The paper is structured as follows. First, I discuss how recent professional and scientific developments challenge traditional notions of the ageing body; next, I present data showing how in this field knee cartilage is being linked discursively to 'diseases of old age' by scientific and industry actors; I then briefly introduce the range of techniques now widely framed as 'regenerative medicine' and then demonstrate the range of technologies being developed specifically in the international cartilage industry and how they are involved in emerging clinical trials and medical practices where the age of participants and concepts of ageing are important. Finally, I present a concluding discussion questioning the ways in which the regenerative cartilage industry is or is not re-fashioning old age, asking how these developments relate to broader concepts of the nature of ageing as sociomedical identity and as an aspect of mortality, and touching on the issue of human enhancement.

2. Methodology

The data presented and analysed here draw on textual content analysis of scientific journals and conferences in fields including orthopaedics, rehabilitation, regenerative medicine and sports medicine, on accounts of professional and industry activity, guidance published by regulatory agencies, media representations of scientific developments, and reports of clinical trials in the emerging zone of regenerative cartilage repair and regeneration. The main focus is on material relevant to the UK, especially in the case of clinical services and trials, augmented from other countries where prominent scientific and technological development has been occurring. My selection of sources was informed by knowledge of the field gained through extensive research over a number of years focused on the regulation of tissue-engineered technologies in the EU regime and the UK case in particular. Additional material such as the epidemiology and the medico-scientific discourse linking cartilage injury to osteoarthritis was identified through multiple online purposive keyword searches using *Google* and *Google Scholar*. Some key journals such as orthopaedic and sports medicine journals were searched individually.

3. Construction of ageing bodies and ageing in society

We are witnessing an age of the redefinition of ageing. Ageing has become a major site of multiple knowledge practices. The biomedical sciences, clinical science, medical

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