"Pasts, Presents and Futures of Medical Regeneration"

Workshop 2: Regeneration: Concepts, Cultures and Practices

Report

The venue for the second project workshop was the Thackray Medical Museum in Leeds. Housed in the former Leeds Union Workhouse, now part of the St. James's University Hospital site, the museum opened in 1997 and welcomes local, national and international visitors, scholars and researchers with interests in the histories of health and medicine (www.thackraymedicalmuseum.co.uk). A number of participants who attended the first workshop were joined by new attendees to discuss "Concepts, Cultures and Practices" surrounding medical regeneration over two days: Monday 4th and Tuesday 5th April. Principal Investigator Dr James Stark opened with a re-cap of the key issues which had emerged from the first meeting: definitional differentiation between "regeneration", "enhancement" and "rejuvenation"; differences between "preventative" and "restorative" practices and treatments; "natural' vs 'artificial" interventions and the extent to which regenerative practices reinforce contemporary ideologies of race, class and gender. In the brief introductory round-table which followed, a number of participants from the first workshop described the ways in which those discussions had begun to shape their thinking and scholarship.

Dr Cheryl Lancaster delivered the first presentation of the day, titled "A History of Stem Cells in Regenerative Medicine". Dr Lancaster holds a PhD in Stem Cell Biology from the School of Biological and Biomedical Sciences at Durham University and is currently nearing the completion of a second PhD in the History of Embryonic Stem Cell Research at the institution's Department of Philosophy. Drawing on her experience of growing artificial skin in a laboratory setting, she cited skin growth as one of the most significant forms of daily bodily regeneration. Combining her expertise as a biological scientist and a historian of medicine, Dr Lancaster offered a broad chronological overview of landmark moments in stem cell research, divided into three phases: pre-twentieth century; early-twentieth century and the mid-twentieth century onwards. Beginning with Abraham Trembley's mid-eighteenth century experiments with 'hydra' polyps capable of regeneration after dissection, Dr Lancaster noted that this research was received differently by biologists who subscribed to preformationism (the belief that the form of living things exist, in real terms, prior to their development), and those with an epigeneticist view (that plants, animals and fungi develop through cell differentiation). Describing Wilhelm Roux's work on embryonic development and Hans Driesch's cell separation experiments with sea urchins in the late nineteenth-

century, Lancaster then considered Thomas Hunt Morgan's 1901 publication *Regeneration*.[1] From an epigeneticist perspective, Morgan proposed two methods for regeneration and described it as a "special problem", incorporating some aspects of normal development but sometimes reflecting abnormal circumstances. After citing Ross Granville Harrison's work on the outgrowth of "neuroblast" cells; Alexis Carrel's interest in the medical potential of regeneration at the Rockefeller Institute in New York, and early experiments in the xenotransplantation of frog and salamander embryos, Lancaster arrived at the work of T.H. Morgan in the 1930s. Morgan proposed two types of regeneration: remodelling and proliferation, which he suggested could be influenced by environmental factors. Research and theory concerning regeneration from the mid-twentieth century onwards primarily focused on form. The consequences of two world wars brought tissue transplantation to the foreground of medical research. Stem cells acquired a further significance in the 1960s with research into bone marrow transplants. Embryonic stem cells in mice were isolated in 1981 and the isolation and culture of human embryonic stem cells followed in 1998. Dr Lancaster concluded with the observation that in the week prior to the workshop, human skin capable of sweating and growing hairs had been grown from pluripotent stem cells. The discussion which followed raised vitalistic questions about the "drive" of particular organisms towards growth, regrowth and life. The correlation between those interested in the body's developmental processes and social organisation was also interrogated: the British scientist Joseph Needham, whose 1942 book *Biochemistry and Morphogenesis* addressed progress in regeneration studies and the remaining challenges, was also the founder of the left-wing Theoretical Biology Club.[2] Dr Lancaster closed the discussion with a reflection on the feedback loops between scientific research, public opinion and legislation.

Following a short break, participants divided themselves into small, cross-disciplinary groups to address broad conceptual questions surrounding medical regeneration more closely:

- What is the scope of "regeneration"? What does it mean to "regenerate"?
- What are the distinguishing features of "regeneration", "rejuvenation", and "enhancement"?
- How might we distinguish between strategies of prevention and practices of repair/treatment?
- Why, and to what extent, has ageing been viewed as pathological?
- How do race, gender and class map onto ageing and regeneration?
- How can an understanding of historical regeneration inform current/future practice?

Participants reflected that the dictionary definition of "regeneration": "the action of coming or bringing into renewed existence; recreation; rebirth; restoration", was in some ways insufficient to describe the broad range of practices under discussion across the project. In its emphasis on restoration, for example, it does not easily encompass preventative health

[1] Thomas Hunt Morgan, *Regeneration*, (New York: The Macmillan Company, 1901).

[2] Joseph Needham, *Biochemistry and Morphogenesis*. (Cambridge University Press, 1942).

strategies such as diet and exercise. Meanwhile, "rejuvenation" is a more delimited term, implying a temporal return (i.e. to a former state of "juvenescence") – the recapturing of youth or superficial refreshment of an organism. "Enhancement" invited the sense of "going beyond" or "exceeding" a present state, and has found a particular place in the language and practices of Posthumanism (see, for example, bionics). This latter term also has political connotations: the modification of the human body according to socially, culturally and economically-defined categories of the "normal" or the "ideal" has been a characteristic element of social eugenics, and also features in discourses surrounding disability. Addressing the difference between strategies of prevention and treatment more directly, the group considered the pathologisation of ageing and the identification of physical and sexual functionality as desirable attributes throughout the life-course. For example, Professor Webster noted shifting sociological and medical attitudes towards sexual activity in care homes: previously prohibited, it is now viewed increasingly as part of a healthy ageing process. Professor Webster and Dr Aske Juul Lassen raised the significance of the term "rehabilitation" and the growth of associated practices in Denmark which would later be the topic of Dr Juul Lassen's presentation. "Rehabilitation" also gestures towards a sense that regeneration might take place not within the body but outside it, in its surrounding environments.

The "economics of regeneration" is an important area, and in considering the possibilities for engineering environments to accommodate the physical capacities of the aged, we might draw on work carried out in disability studies, such as the identification of medical and social models of disability. Project Research Assistant Catherine Oakley drew attention to the controversy surrounding a recently-published book by the author and academic Adam Perkins which claims an epigenetic basis for welfare dependency amongst certain sections of the UK population. The book has received the endorsement of a Conservative Party thinktank.[3] This prompted participants to reflect on the "mis-use" of science and its co-optation by political and/or economic agendas.

In the second presentation of the day, Dr Robert Guilliatt offered an "Insider's View of Regenerative Medicine". Dr Guilliatt, a postdoctoral research scientist at the University of Leeds, is currently working for tissue and eye services at NHS Blood and Transplant, where he is researching the recellularisation of decellularised human skin for the treatment of large area burns and the development of skin equivalents. He began by emphasising that the field is driven by a need to find treatments to assist those in medical need and by offering a definition of regenerative medicine as "the application of scientific principles to repair, restore, supplement or replace the natural function of a biological system". Traversing traditional disciplinary boundaries, it incorporates areas such as stem cell research, signalling, biomaterials design and biomechanical testing. Research in regenerative medicine is linked closely to clinical practice. In many cases, the preferred approach is to trigger or assist the body's own regenerative processes. If *in situ* regeneration is not possible, the aim then is to restore functionality. Dr Guilliatt's observations were grouped into three categories: "where we were"; "where we are" and "where we are going". Scientists have achieved the isolation, culture and characterisation of cells and have been able to treat patients with cellular

[3] *The Welfare Trait: How State Benefits Affect Personality*. (Palgrave Macmillan, 2015).

pathways. Biocompatible, biostable and bio-reabsorbable materials have been developed for use in synthetic grafts and hip, knee and spinal disc replacements. Advancements have also been made in biomechanics and in physiotherapy. Current work is being undertaken in the chemical structure and mechanical properties of cell responses to different materials. In biomechanics, work is being carried out on material wear and tear and different surface coatings. There is also a growing understanding of the importance of stimulus to normal cellular function. Describing future objectives and directions, Dr Guilliatt referred to the "Trinity of Regenerative Medicine": combining the correct cells in the correct material with the correct stimuli to repair tissues and to grow replacement tissues and organs. His own work focuses on the decellularisation of human dermis to achieve cells with the correct properties that are not immunogenic. This is driven by a clinical need to treat patients with extensive burn injuries where auto-grafting is not an option. Dr Guilliatt concluded his presentation with an overview of the possible future directions of regenerative medicine. New potential treatments and interventions are at various stages of development. In the short-term, early stage intervention and improved replacements are likely to be the main outcomes. The growth of fully functional replacement tissues and organs is an end goal which may take decades to achieve. Significant challenges remain, including ethical constraints; questions surrounding regulation; clinical uptake and public perception. Funding is also an issue: despite government commitments, anecdotal evidence suggests that the number of successful grant applications have dropped.

In the final session of Day One, Andrew Webster, Professor in the Sociology of Science and Technology and Director of the Science and Technology Studies Unit (SATSU) at the University of York, spoke about regenerative medicine and biomedical innovation, drawing on his recently published co-authored article in the journal *Regenerative Medicine*.[4] This paper considers particular features of regenerative medicine, asking what distinguishes it from other practices, and explores the challenges for policymakers in three key areas: clinical trials; regulation (at both national and EU level); and manufacturing, scale-up and logistics (including biobanks and distribution). The group discussion which followed addressed contrasting international approaches to regenerative science.

Day Two opened with a presentation from Dr Aske Juul Lassen. An ethnologist specialising in ageing studies with a focus on everyday life, he holds a PhD from the Centre for Healthy Ageing at the University of Copenhagen. His current work, with the Centre for Healthy Ageing (healthyageing.ku.dk) and the CALM project (calm.ku.dk) explores the ways in which active ageing transforms old age from a period of passivity to a life phase characterised by activity, engagement and social participation. Dr Juul Lassen's presentation, titled "Cycling in Old Age as Regenerating? On Local Versions of Active Ageing and Co-Creation", explored active ageing initiatives in Copenhagen. First launched in 2012 and funded by local budgets for active citizenship, "Cycling Without Age" ("Cykling Uden Alder") now extends across multiple municipalities. The project aims to encourage older people to get out

[4] John Gardner, Alex Faulkner, Aurélie Mahalatchimy & Andrew Webster. "Are there specific translational challenges in regenerative medicine? Lessons from other fields." *Regenerative Medicine* 10.7 (November 2015): 885-895.

on bikes. As passengers on rickshaw bikes operated by volunteer "pilots" (often in their sixties), older people participate socially through conversation. Alternatively, side-by-side bikes with dual pedals enable participants to take turns as passenger and pilot, engaging in physical activity through shared effort. This initiative is designed to create intergenerational dialogue, to increase quality of life through community participation, and to maintain or restore functional capacity. The scheme has received powerful testimonials from both the passengers and pilots involved.

The World Health Organisation defines active ageing as "the process of optimising opportunities for health, participation and security in order to enhance quality of life as people age".[5] Dr Juul Lassen highlighted the plasticity of ageing within this definition, and cited Townsend's theory of "structured dependency": the idea that old age can be "unmade" through alterations to the institutions in which it is embedded.[6] He also observed differing emphases in approaches to ageing policy at the WHO and at EU level, noting that the former is concerned primarily with physical activity, and the latter with lifestyle and community engagement. Initiatives such as "Cycling Without Age" follow a model of "co-creation", configuring individual citizens as partners in the delivery of public services. More recently, active ageing programmes in Denmark have begun to explore the possibilities inherent in digital technologies. Virtual cycling programmes, which take participants on a visual biking tour around their old neighbourhoods, are designed to facilitate the temporary recapture of cognitive abilities and reconnection to old memories, in individuals with dementia. In the discussion which followed Dr Juul Lassen's presentation, group participants noted the increasing shift towards individual responsibility for healthy ageing, questioning whether this has been accompanied by a corresponding change in social attitudes towards those perceived to eschew this responsibility. In the discourses surrounding active ageing, "normality" is usually synonymous with "functionality". This also implies an independence which relieves the burden on health care infrastructures.

The second session of the morning converged on "Material and Visual Cultures of Regeneration". Participants engaged in an object-handling session introduced by Lauren Ryall-Stockton, Curator at the Thackray Medical Museum, exploring a number of objects and artefacts associated with commercial rejuvenation and regeneration from the late-nineteenth and early-twentieth centuries, including electrotherapy devices, vitamin pills, and advertisements for "gland treatments" to restore youthful vitality. Participants considered a number of questions: Who used these products? Why might they have been regarded as effective? What ideas about "regeneration" are at work in their promotion? In what ways have substances been inscribed with regenerative capacity? And what can we learn from the material culture of regeneration?

The closing roundtable drew together various strands of discussion from the two-day workshop under the heading "Researching Regeneration: Where Next?" The object-handling

[5] http://www.who.int/ageing/active_ageing/en/

[6] Peter Townsend, "The Structured Dependency of the Elderly: A Creation of Social Policy in the Twentieth Century". *Ageing and Society* 1.1 (January 1981): 5-28.

session was the topic of initial dialogue. Participants noted the language of expectation characteristic of the advertising materials uncovered, and drew comparisons with "aspirational medicine" in the present day. Other conversations focused on regulation: if such patent medicines were effective – even if only psychosomatically – is this an argument for greater permissiveness in approaching the medical marketplace? Thinking about commercialisation more broadly, is regenerative medicine operating in harmony with pharmaceuticals or seeking to displace them? Dr Stephen Curtis noted that speculative fiction is an area closely engaged with ethical concerns about the progress of science. Recent narratives have directly addressed the corporatisation of bodily organs, whilst the rise of the zombie in popular culture, as a sub-prime member of society, can also be interpreted as the abject embodiment of "anti-active ageing".

In planning for subsequent discussion and research, the group considered the importance of an international dimension within the project, to expand its current focus on Western medicine and society. This might include work on stem-cell research and active ageing policies in China and/or India, together with anthropological perspectives on age in developing countries. Is ageing predominantly configured as a malign process, as opposed to a benign one? Finally, picking up the threads of Dr Curtis's observations on speculative fiction, Dr Stark suggested an exploration of regeneration in contemporary literature as a productive area of future enquiry. Catherine Oakley added that there is a need to develop better understanding of the discursive feedback loop between medical developments, public perception and cultural production. Gathering specific evidence for the influence of cultural forms on scientific practice is a difficult task, but it is clear that culture creates the conditions in which certain types of science can flourish, or fail.

The third and final workshop will take place at the University of Leeds on Wednesday 6th and Thursday 7th July, 2016.

Questions and feedback on the workshop or the project in general should be addressed to PI Dr James Stark (J.F.Stark@leeds.ac.uk) or Research Assistant Catherine Oakley (C.M.C.Oakley@leeds.ac.uk).

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