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The Early History of Tissue Culture in Britain: The Interwar Years

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SUMMARY

The technique of tissue culture has, throughout the twentieth century, become a mainstay of biomedical research, and exists today as a celebrated scientific tool. However, an examination of its early history demonstrates that it was once contested, with professional opinion differing as to its value to science and medicine, and, crucially for the purposes of this article, considerable public awareness of its potential and perceived pitfalls. Here, the hitherto neglected situation in the early British history of tissue culture will be studied, with the focus being the work performed at the Strangeways Research Laboratory in Cambridge during the interwar years of the last century. Examination of the early life of this institution shows that scientists eager to stress the technique's viability tapped into popular sentiment to overstress its potential, in a fashion reminiscent of earlier experimental biologists and their contemporary American counterparts. This ultimately backfired on British culturists as the press coverage of their work became incredibly sensationalist, and increasingly sinister in tone, and scientific fact and fantastical speculation became inseparable.

Keywords

tissue culture; experimental biologists; popularization; test-tube babies; secrecy; 'Brave New World'

Introduction: An Unwelcome Intrusion

On 4 February 1935, an agitated Honor Fell, the director of the Strangeways Research Laboratory (hereafter SRL) in Cambridge, wrote to Sir Henry Dale of the Royal Society, expressing her 'considerable anxiety' at an uninvited visit to her laboratory by a newspaper journalist.1 Sounded out by his editor, the journalist had taken a trip to Cambridge in order to see the spectacular tissue culture work that was allegedly taking place there. Unperturbed by her refusal to speak with him, the reporter nevertheless composed, in Fell's words, the 'most fantastic story and included in it a distorted version of my conversation with him so that his production looked as if it had been sanctioned by me'.2

Sir Henry's reply was instant and unequivocal. On no account, he advised, should Fell grant journalists any response other than cold disdain. 'Refuse to see, or to communicate with any newspaper reporter in any circumstances', he counselled, adding that 'you will soon find they get tired of it, and the trouble dies down'.3 Taking heed, Fell did just as her senior advised. In subsequent contemporary newspaper reports and, crucially, in later historiography, this refusal to co-operate with the rumours surrounding the work she and her team were performing led to her characterization as a reticent figure, hiding some malevolent truth, and keen to keep the public in the dark. In a 1998 article in the *Lancet*, Andrews and Nelkin cited Fell's refusal to engage with public interest as the typical response of a scientist who works on, or is seen to work on, bodily material; a response they alleged is symptomatic of and furthers the growing gap between scientific and social views

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of the body.4 Tissue culture research in interwar Britain, and those engaged in it, thus became incorporated into the burgeoning literature on the scientific use of tissue in research and its attendant popular anxiety.

This article takes issue with this incorporation, arguing that both Fell's reaction and popular unease at tissue culture research does not fit into the simple historiography of appropriation and opposition presented by Nelkin and Andrews.5 In the wider literature, both scientific and popular attitudes to tissue and work performed on it appear static, existing either side of a stark dichotomous divide where the former views it as a reified commodity to be procured and worked on, and the latter views it as anything but. Techniques such as tissue culture, it is claimed, only further increase scientific attitudes to human material and further inflame public anxiety. In line with this framework, therefore, it is little wonder that Fell's dismissal of press interest should be interpreted as it has; read by Nelkin and Andrews as a legacy of evasive nineteenth-century anatomists and a precursor to modern researchers who dismiss popular unease as plain naivety.6

It would appear, on such circumstantial evidence, to be so, but one needs to look further into Fell's anxiety to reach the true roots of this media interest and the debate that spawned it. What particularly disturbed Fell in fact, more than the journalist's prying, were his claims that: '(a) we are on the point of creating life and (b) *that we are about to grow babies in bottles*'.7 Look further into this latter claim and we see the legacy of a scientific debate that turned into a popular controversy, indelibly particular to Britain in the 1920s and 1930s. With this in mind, it is now possible to refute the claims of authors who attempt to cite tissue culture, and the debates it spawned, into an overarching historiography. Focusing primarily on frames of reference used to characterize past controversies, then applying these to events occurring in different sites, at different times, obscures understanding of instances that are wildly removed from much-cited disputes. It also fails to appreciate the novelty of objects such as tissue culture and the socio-cultural milieu in which they were constructed. In showing how presentations of tissue culture stoked and were directly influenced by contemporary popular fascination and broad social concerns, this article locates itself within a growing body of literature that aims to show how disputes over tissue used in research are shaped by and interact with wider cultural narratives.8 Such an approach reveals the fallibility of relying on reference to a dichotomous chasm between scientific and social interests, arguing instead that one should pay close attention to both the relevant scientific, social, and historical context in which debates arise, and the reciprocity between professional and popular constructions of contested tools derived from bodily material.9

The hypothetical, but seemingly imminent, 'test-tube baby' had become very much *the* popular representation of the avenue down which biology was taking society during interwar Britain, emblematic of a general fear at the seemingly manipulative power of experimental biologists. It represented the literal conflation of contemporary fascination with the power of experimental biology and general social concerns over better breeding and population health. The test-tube baby was, of course, intensively popularized by Aldous Huxley in his dystopian *Brave New World* of 1932. Crucially, as will become clear, Huxley relied on the relatively new technique of tissue culture to lend credence to his vision of a dark future, where humans could be eugenically manufactured on Taylorist production lines. But the connection between tissue culture and test-tube babies arose first in the 1920s, due, in large measure, to a *scientific* debate regarding tissue culture's potential as a research tool.

Tissue culture had been, from the outset, publicly visible, not shrouded in secrecy as one might expect from much of the literature. This popular visibility was initially inextricably bound with, and stemmed from, the professional interests of scientists, rather than authors or journalists; a fact which further demeans the traditional separation of scientific and popular

constructions of body tissue. From the very moment, in 1918, when it was introduced as an experimental tool to the UK, tissue culture's value to science and medicine was intensively contested. Those scientists who turned to cultures as research tools, through an increasing institutional commitment to basic research, were forced to stress its potential. They often did so in a popular arena, critically tapping into public fascination when they spoke of its advantages. Thus, behind the early presentation of the technique as possessing 'stupendous possibilities',10 which then justified fictional visions of the future, are the claims of a band of experimentalists eager to assert tissue culture's viability. The journalistic intrusion and scientific dismissal Andrews and Nelkin report is irrevocably one outcome of *this* particular historical situation, not a general tension over research on tissue.

The following article also engages with the wider literature on another level. In examining the rhetoric and public engagement used by advocates of tissue culture, then charting how these rebounded in the form of sinister rumours, this is another example of how sensationalist presentations of an innovation can work against practitioners in the long-run; located within a literature on the 'politics of drama' involved in constructing a particular tool.11 Following the approach of Cantor and Pieters, I isolate the vested interests that resulted in tissue culture being oversold as a miracle technique, noting too the various parties involved in this construction. I extend the reach of analysis beyond the community of scientists who worked on tissue culture and focus also on other actors engaged in this presentation, such as popular fiction and science writers and newspaper journalists. But in examining how these figures seized on professional rhetoric, and to fully appreciate how the situation that confronted Honor Fell arose, it is necessary to examine first the scientific context in which tissue culture was introduced to Britain from the USA, and it is to this that I now turn.

Tissue Culture in Britain: T. S. P. Strangeways

(i) Investigating Living Cells: Tissue Culture comes to Britain

Pathologist Thomas Strangeways trained and qualified at St Bartholomew's Hospital, London, during the latter part of the nineteenth century. When his mentor, Alfredo Kanthack, left for Cambridge University in 1895, Strangeways promptly followed to act as his demonstrator. Kanthack succeeded C. S. Roy as Professor of Pathology in 1897, inheriting an ethos where basic laboratory research took precedence over clinical work.12 He intended to build upon this ethos, but following Kanthack's death a year later, the research of the pathology school became more clinically oriented under his successor, German Sims Woodhead.13 This shift in emphasis suited Strangeways, who had long held a desire, as his wife attested, to 'make a systematic investigation of some important diseases, the pathology and treatment of which are as yet undetermined'.14 Keen to pursue this aspiration, buoyed by support from Woodhead, and having managed to secure enough financial support from personal income and private bequests, Strangeways managed, in 1905, to convert a small house in a local suburb into the Cambridge Research Hospital, with five beds.15

Strangeways' particular 'scheme' for investigation involved direct clinical experimentation. 16 He informed all prospective patients of the peculiar situation with which they would be faced under his supervision, telling them they were there for necessary observation and research, not primarily for treatment.17 Although many individuals were more than happy with this scenario, accepting any circumstance that involved even slight alleviation of their symptoms, Strangeways was soon to become frustrated with the situation as it stood. A combination of ongoing financial paucity, the small size of his research cohort, and constant commuting to and from London for samples of tissue led, it would seem, to his constant exasperation.18

Thanks to sizeable private donations, a larger hospital was built, which opened in May 1912. However, after the First World War, when the Research Hospital was used for convalescing officers, Strangeways stopped admitting patients and chose a different mode of study, which was to cement both his reputation and that of his hospital. Around 1919, he turned to the study of living cells *in vitro.* In the words of an official retrospective, written three years after his death, Strangeways:

> became convinced that in order to gain further insight into the pathological processes which produce arthritis, it was necessary to investigate behaviour of living cells. With characteristic energy he took up the study of tissue culture. This method placed a new weapon in the hands of the biologist and Strangeways was quick to see its importance.19

Thus, as patients were discharged, few new cases were admitted, and Strangeways devoted his time and energy to undertaking a thorough investigation into the application of tissue culture. These basic early culture studies were far removed from the earlier research on ailing patients, with Strangeways examining mitotic division of cells from the eyes of chick embryo and cartilage from adult fowls *in vitro,*20 and formation of binucleate cells in culture.21

Retrospectives written by colleagues at the Research Hospital portray this shift to culture as something of an epiphany, with Strangeways instantly becoming unstinting in his belief in the power of this relatively new method from the outset.22 Historical research shows, however, that his shift to *in vitro* research cannot be understood fully without an appreciation of the shifting institutional and epistemological climate biologists faced immediately after the First World War. Pressure from the Medical Research Council (hereafter MRC), the Hospital's primary source of money from 1917, also played a significant role in Strangeways' move to fundamental *in vitro* research.23 Walter Morley Fletcher, the Council's inaugural secretary, envisaged Cambridge at the forefront of pioneering, *basic* research, and cited the Research Hospital as part of this vision, exerting pressure on Strangeways to commit fully to experimental culture methods. It is perhaps not surprising that Fletcher forced Strangeways to undertake such a change, for he was a student of experimental physiologist Michael Foster, who was immensely influential in persuading British biologists to *manipulate* life in the laboratory, rather than simply observe it.24 Indeed, tissue culture itself was fostered by this ideology, for Foster's pupil, H. Newell Martin, left Cambridge to become Johns Hopkins University's first professor of biology in 1876, and there taught embryologist Ross Harrison, who would, in 1907, fashion the first tissue cultures to settle a dispute regarding nerve outgrowth.25 From the outset, Harrison displayed the technique as an indicator of the progress made by, and potential of, this new biology, claiming that 'it is recognized in science that the experimental method is vastly more efficient . . . than the method of merely observing phenomena as nature presents them to us'.26

Those schooled in the experimental mind-set, who dominated the biological landscape in Cambridge during the Research Hospital's inception, clearly agreed. Thus its, and by extension, Cambridge's role as the focus of tissue culture research in Britain was certainly no accident, and can clearly be cited amongst wider shifts in research traditions. The advent of clinically promising work at the Research Hospital appeared to vindicate faith in the experimental method. The formation, in 1923, of the MRC-funded 'Strangeways Team' between the Research Hospital and St Bartholomew's, which aimed to investigate tissue culture's application to radiological research, would have undoubtedly satisfied Fletcher, who was stressing the need for basic laboratory investigations into the pathological and physiological bases of cancer at a time when much research in this field still maintained a directly clinical bent.27 At the outset, Strangeways simply established cultures to send to

London, which were then irradiated and examined by radiologists. However, early results using cultures were so promising, such as Strangeways' finding that cells were most sensitive to radiation at a pre-mitotic stage, that work was transferred wholesale to Cambridge.28 Success also presented a boost to researchers at the Research Hospital, who maintained that tissue culture would have a bearing on clinical practice. Indeed, in doing so, they aped the rhetoric of earlier experimental biologists such as Claude Bernard, who drew an analogy between the microcosm of an experimental body and the macrocosm of the patient, or society as a whole, to stress the benefit that his often contested vivisection work held.29 A member of the radium collaboration, radiologist Frederick Spear, clearly fell into this camp, stating that: 'We must not be afraid . . . of losing sight of the patient in his bed in order that, armed with a scientific basis for our methods we may return to him with ultimate hope of his deliverance'.30

Whilst the shift to basic culture research at the Research Hospital can be understood amongst broader trends toward the experimental method in Cambridge and elsewhere, it is crucial to note that tissue culturists clearly envisaged their method as superior to other modes of work, and considered themselves a breed apart. An apocryphal story quotes Strangeways' excitement at first examining mitotic division in culture, as he was looking not at stained histological specimen, but '*at the thing itself* '.31 Thus distance was consciously established between culture researchers at the Research Hospital and other Cambridge sites of experimental research, such as J. N. Langley's School of Physiology, through the perceived advantages of this 'infant of promise'.32 It was, Spear noted, a 'melancholy change' to pass from the study of a living unicellular organism to minute anatomy of a higher organism by means of stained, moribund preparations such as Langley's; like 'passing from the village green gay with the liveliness of children at play into the gloom and morbidity of the borough mortuary'.33 How could one hope to understand cellular processes through examination of dead samples? 'Something is lost in the process', Spear noted, 'and something vital . . . but *tissue culture makes dry bones live*'.34

Others were not slow to see the method's potential, and scientists began to come to Cambridge specifically to work with Strangeways. Young zoologist Honor Fell journeyed from Edinburgh in 1923, and in conjunction with Strange-ways perfected the *in vitro* growth of whole organs, known as 'organ cultures'.35 This marked progression of the Hospital's research into developmental work, with the pair observing the organized growth of both chick cartilage and eyes in culture, and Strangeways successfully culturing whole chick blastoderms. Researchers keen to learn the technique of tissue culture also visited the hospital with increasing regularity, fulfilling the MRC's remit of providing instruction in practical methodology. This combination of the increasingly dynamic nature of the research being undertaken and the rate at which visitors were attracted ensured that by 1926, Strangeways' Hospital had become an internationally renowned British centre for tissue culture, with its founder established as the 'master of investigation in living cells'.36

(ii) In Support of Tissue Culture

The powerful rhetoric of tissue culturists such as Spear cannot be fully comprehended without appreciating also that it was, in part, borne out of stinging criticism aimed at the technique. For every admirer who, Spear admitted, may 'overstate its possibilities', there was a 'critic who will affirm that nothing whatsoever will ever come of it'.37 The reason one finds the names of Strangeways and his colleagues so entwined with the growth of cultures in Britain lies in the strength of their faith in this 'new weapon'. Like other high profile figures, they not only steadfastly believed in the power of culture to shed light on human phenomena, but were also not afraid to say so in public.

The strength of this conviction is clearly demonstrated in the final course of lectures Strangeways gave to Cambridge students in 1926, at a time when tissue culture's validity was vocally being called into question in Britain. Three years prior to these lectures, the *Lancet* offered a bleak assessment of the technique's achievements thus far, stating that whilst it offered promise, 'its fruits have hitherto been meagre and far from encouraging'.38 This editorial prefaced the publication of a series of three lectures given by A. H. Drew at University College London, which focused primarily on method. Tellingly, in dwelling far more on practical issues than on speculating where the results of his investigation might be expected to lead, Drew was, the *Lancet* noted, acting with 'characteristic reticence', in, it was implied, admirable contrast to certain figures who unrealistically raised expectations.39

One such figure, Alexis Carrel, came to the UK in 1924 to address a meeting of the British Medical Association in Bradford. Carrel, a Nobel Prize winning surgeon, and head of the Rockefeller Institute's Department of Experimental Surgery, was very much the public face of tissue culture in the USA. Prior to the inception of the Research Hospital he appeared inseparable from any mention of the technique in the British popular press. Like Spear and, as we shall see, like Strangeways, Carrel was convinced of the medical relevance of tissue culture and often expressed these opinions forthrightly in his papers, proclaiming that the technique 'will be helpful in the exploration of unknown fields of human pathology'.40 Carrel and his research team at the Rockefeller Institute are also notable for the way in which they deliberately set out to ensnare popular consciousness in order to convey the potential they saw in tissue culture. This tactic paid dividends in gaining exposure for the technique, as the notion of growing cells apart from their corporeal source, and maintaining them in laboratories, conveyed powerfully the potential of the new biology and astonished journalists and laypeople alike.41

Carrel consistently used his high profile to make ever more spectacular claims regarding tissue culture's potential. These proclamations served a distinct purpose, in defending the technique from increasing scientific disparagement. Many researchers, lacking Carrel's technical aptitude and financial resources, met with regular failure when they attempted to culture tissue. This fact, coupled with Carrel's dogmatic hygiene procedure, which lent the technique an air of impenetrability, dampened early enthusiasm for tissue culture. Thus, the spectacular claim, in 1912, that Carrel had established an *immortal* culture of chick-heart cells demonstrated not only his belief that the lifespan of all somatic cells *in vitro* was potentially infinite, but was also a typical way of defying escalating criticism of tissue culture's value.42 The immortal culture thus served as vindication of both Carrel's faith in the method and the method itself, indicating that it could shed light on and offer control of not only pathological problems, but also seemingly intractable phenomena, such as ageing.

The notion that the elixir of immortality had been cornered by scientists sent the press, unsurprisingly, into a tumult of activity. What is notable here, however, is the way scientists fed public fascination in this increasingly famous chick-culture, deliberately drawing on popular discourse to convey awe in the technique's potential at a time when many questioned it. Scientists focused attention on the division of cultured cells, invoking fantastical notions of potential physical scale to portray culture's seemingly limitless boundaries. Albert Ebeling, a technician of Carrel's, stated in the *Journal of Experimental Medicine* that if the cells were allowed to grow unchecked, 'their mass would be greater than the sun!'.43 As scientific authority appeared to back up such wild claims, they reappeared regularly in the press, with tissue culture often transformed into a giant rooster, or a monster that could potentially engulf New York. The crucial point to bear in mind here is not the implicit menace in such portrayals, which is encountered in due course, but the fact that hyperbole surrounding cultures was a deliberate *scientific* construct.

Nevertheless, by the time Carrel arrived in Britain, scepticism surrounding tissue culture's medical value persisted, and he was forced to concede that 'attempts made during the past years to apply . . . tissue culture to pathological studies did not meet generally with great success'.44 Such an admission, however, was not merely confined to the medical press. Given Carrel's high profile, *The Times* covered his address, and the British dispute over tissue culture's worth was thus played out in a very public arena.45

The same year, Strangeways was aligning himself alongside Carrel (who still maintained in Bradford that tissue culture was a powerful method with distinct potential), claiming in a practical manual that it would become 'one of the most valuable methods of biological research'.46 What is notable here is how this belief publicly manifested itself, with Strangeways shrouding discussions of tissue culture in fashionable speculation designed to ensnare popular fascination. His 1926 lectures on tissue culture offer a notable contrast to Drew's measured series from 1923, demonstrating neatly how he borrowed the populist rhetoric of his experimental predecessors, feeding the fascination with biology's potential in the early decades of the twentieth century, whilst also inadvertently bolstering the fantastical speculation of which later reports on his laboratory were all too guilty.

Strangeways' talks did not share Drew's, nor the *Lancet's*, caution. Like Carrel, he believed that the boundaries of tissue culture's possibilities were defined by the skill of the individual working on them and not by the technique itself. Thus, when referring to the potential for keeping somatic cells alive *in vitro* indefinitely, Strangeways asserted that: 'So far as we can judge, the life in vitro of many somatic tissues is limited *only by the patience and longevity of the experimenter*'.47

Strangeways' demonstration of his belief in tissue culture's possibilities went much further than merely outlining what defined its limitations. He also drew upon the traditional flourish of previous pioneering biologists, such as Bernard and Carrel, which involved asserting how research performed on a certain experimental entity would shed light on *human* phenomena. Consequently, in a powerful opening statement to his inaugural lecture, he asserted that the 'three essential constituents of the animal organism' that his team researched on *in vitro*, namely the cell, intercellular matter, and body fluid, resulted in: 'the functions of the body; in reproduction, respiration, digestion, excretion, locomotion etc . . . the complex physiological processes included under such terms as "instinct" and "reason" . . . the triumphs of engineering, the music of Bach, the poems of Milton, the genius of Michelangelo, and the weekly production of "Punch"'.48

Clearly, Strangeways was also not averse to making the conceptual jump from the microcosmic environment of glass-bound tissue cultures to the macrocosmic environment of man. Like his contemporaries, he was prepared to make assumptions on the processes that underpinned human behaviour from observations drawn from non-human tissue. Moreover, he delved into his work's relevance to fantastical fictions that captured the imagination of the age; in this case, the widespread popular belief that the laboratory work of experimental biologists had led them to the cusp of artificially creating life.49 After detailing how simple the cultivation of tissues from certain vertebrates was, and how the 'tissue of the embryo may be readily grown in vitro', Strangeways then declared to his audience that: '*It will thus be seen that the idea of a "test tube baby" is not inherently impossible*'.50

Strangeways was certainly not the first to make the link between culturing tissue and growing babies in bottles. Prominent figures within science and literature had already drawn public attention to this wild possibility, which seemed to suggest the power of biology to radically alter the fabric of society more than any other. Instigator of this vision was the geneticist J. B. S. Haldane, who wrote in his *Daedalus, or Science and the Future* of a time

when one would observe the rational *production* of ectogenetic babies as the norm, with 'less than thirty per cent of children born of woman'.51 Haldane formed part of a prodigious group that included his sister, Naomi Mitchison, his first wife, Charlotte, and family friends, Aldous and Julian Huxley, which produced popular work centring on the implications of scientific progress. Barring Mitchison, all of these were to have some influence on the popular portrayal and perception of tissue culture in the 1920s and 1930s.52

Haldane ensured *Daedalus* was rooted in contemporary thought by introducing the theme of scientifically manufactured infants in an era obsessed with reproductive health and control, when popular consciousness was all too aware of technical advances in artificial birth management, and increasingly preoccupied with the post-war population decline.53 He maintained this fiction's plausibility by extrapolating his vision from scientific work in progress. Crucially, developments in tissue culture fell firmly within his selective remit, forming the underlying basis for his babies in bottles. As *Nature* noted in a review, Haldane's work did not seem so far-fetched if 'what has already been done with tissue culture is considered'.54 Appreciation of *Daedalus*, which sold 15,000 copies in its initial print-run, was by no means confined to the intelligentsia of the time.55 The association between tissue culture and the fashionable theme of babies in bottles was fairly well cemented by the time Strangeways made the link explicitly in 1926. Following his death at the end of the year, it was to rebound on the hospital he established.

Tissue Culture in the 1930s: 'Woman Scientist Cultivates 'Life in Bottles'56

Strangeways' sudden death plunged the Research Hospital into turmoil. Without its figurehead, whilst also seriously in debt, it faced, in the words of Spear, 'sudden extinction'. 57 Indeed, at a meeting of its three Trustees in January 1927, only one of them argued for its survival, while the remaining two favoured immediate closure.58 With eventual agreement reached on the hospital's continuation, the Trustees successfully lobbied the MRC for increased funds.

Thus, following a year of uncertainty, the Hospital entered a new phase of stability and expansion with the appointment of Honor Fell as director in July 1928. Although still relatively young at 28 years of age, Fell was sponsored by a Beit fellowship, did not require a salary, and was also already a scientist of considerable repute. With her at the helm, the newly renamed Strangeways Research Laboratory (hereafter SRL) was to see the development of a course in tissue culture technique and an extension of work on malignant cells, encapsulating the laboratory's shift to more applied research. With the SRL buoyed by the combination of a substantial MRC endowment, further individual bequests, and the recruitment of eminent scientists, such as young embryologist Conrad H. Waddington, who joined in 1929, the future of tissue culture in Britain seemed more assured than it ever had in Strangeways' lifetime.

The early years of Fell's directorship were also to see an expansion of press coverage on the work performed at the SRL. Indeed, from the extent of this coverage it is safe to say that the 1930s represented the pinnacle of popular awareness of tissue culture in the UK, with press reports embodying cultures simultaneously as standard-bearers of the potential inherent in biology and also as emblems of the dangers of unfettered scientific progress. Prior to the 1930s most British press reports covered Carrel's work. An offshoot of the SRL–Barts collaboration, with radiologist R. G. Canti's combination of the still nascent technologies of tissue culture and time-lapse cinematography, was to push the SRL itself to the forefront of popular coverage. Canti's work, involving the filming of growth *in vitro* and responses of both healthy and malignant cells to radiation, raised the profile of the SRL like no other research project undertaken there. Countless column inches were dedicated to the images of

irradiated cells that, when shown at numerous scientific conferences, reputedly left audiences 'gasping with astonishment'.59

Over the course of 1931 and 1932, *The Times* ran a number of lengthy articles on Canti's films.60 Neither article dwelt on the possible implications they may have held for medicine and health, however, focusing primarily on the intricacies of his cinematic technique. Indeed, the latter of these two articles even paused to reflect on the shortfalls of tissue culture, stating that 'cultures under artificial conditions seldom remain alive long'.61 Both articles remained free from any pandering to popular sentiment, referring to the cell as 'an organ of mystery', rather than the key to the secrets of disease, death, or life. This more measured tone reflects neatly the scientific awakening to the complexity of cellular phenomena with every new study undertaken. As research progressed it became clear that emerging awareness of such intricacy ensured that discourse surrounding biology's potential was more measured than in the early years of the century.62 Indeed, indicative of this balanced stance was the figure of Honor Fell, who, as I will show in due course, had no time for those who overstated tissue culture's potential.

Sensational stories about breathtaking developments were the exception rather than the rule. 63 Nevertheless, much of the coverage, surrounding tissue culture was notable for the way it bucked this balanced appraisal of biology's prospects. The strength of the claims made previously regarding tissue culture, coupled with its continued portrayal as a technique of boundless (and increasingly sinister) potential by high-profile public figures, following J. B. S. Haldane's lead, ensured that coverage of tissue culture in high-circulation publications such as *Tit-Bits*, the *Daily Mirror*, and the *Daily Express* continued to blur the boundary between science-fact and science-fiction.

In 1932, the weekly tabloid *Tit-Bits* ran a full-page article on tissue culture, describing Canti's work effusively at the outset as 'a British film, *the most wonderful in existence*'.64 The irradiated cultures themselves, rather than Canti, who is not mentioned by name once, are resolutely the focus of the piece. They are portrayed as 'screen heroes', whose study 'it is hoped will solve some of the greatest mysteries of life'.65 This scaling from tissue culture to human, characteristic of researchers such as Strangeways, is a prominent feature in this and many other articles on tissue culture at the time. In the article, Canti's chick cells become imbibed with agency and autonomy. They move, digest, and cast off dead sections as if by themselves—an anthropomorphism that is further enhanced by their characterization as human cells. Almost inevitably, attention turns to the inescapable figure of Carrel and his 'immortal' culture. If its growth had been left unchecked, this mass of cells would have been, we learn, 'as big as the whole world!'66 Whilst this may superficially appear to be no more than an exemplary case of the sensationalism that many scientists derided in popular coverage, it is a repetition of a statement that they themselves had been making on both sides of the Atlantic for over ten years.

What sets the *Tit-Bits* piece apart from earlier press reports on tissue culture is that it notably conveys potential scale in an overtly sinister light, presenting the possibility of 'the earth overwhelmed by a mass of protoplasm' as a 'nightmare worthy of the imagination of H. G. Wells'.67 Lest anyone miss the point, it is driven home by an illustration that presents a sinister mass engaging in what appears to be a remorseless spree of destruction behind a morass of terrified civilians (see Figure 1). Rather ominously, the reader would have pored over the apparent potential menace of cultured tissue, and the duty of scientists to ensure that their work does not cross any permissible boundary, before the article's conclusion turned to the work of the SRL. Thus, on reading that 'by growing eyes and femurs in an artificial medium the workers at Strangeways have achieved a triumph *which may have far-reaching results*',68 there is an ambiguity as to exactly what these consequences may be.

The public awareness that the fruits of the new experimental science were not always beneficial, and that unfettered scientific research could often threaten the status quo were, by this point, definite factors in evaluating new developments, and tissue culture was no different.69

Honor Fell was certainly aware of the press coverage of her laboratory, and clearly intended to raise its profile further in the early years of the 1930s. Her correspondence to the SRL's Trustees during this period illuminates her attitude to the reports that were circulating at the time and shows that she was certainly not as predisposed to hiding her work from public view as has been suggested. In a letter to Malcolm Donaldson on 23 November 1934, Fell raised the matter of a popular book on the work performed at the SRL. She suggests that 'a layman who is an experienced popular author (provided you can prevent him talking bilge) would probably be able to get ideas into the public's skull better than the medical man who is bound to have difficulty in separating himself sufficiently from his technical background'.70 Crucially, although this rather disparaging mention of 'bilge' illuminates Fell's sentiments towards hyperbolic accounts of tissue culture, she clearly wanted any work to be resoundingly populist, as is evidenced by her desire to get her more measured presentation of tissue culture 'into the public's skull'. At the same time, as she did throughout her tenure as Director, she was showing Canti's films to schoolchildren and in lectures, keen to educate as many people as possible in the method and results of tissue culture.71

The popular account envisioned by Fell never materialized. Within two years she was to exhibit an about-turn. When questioned by a reporter as to what her work involved, she responded in a 'dismissive and defensive' way, saying that 'people would not understand . . . I don't think the World should know yet'.72 Her irritation at the original visit from the journalist noted at the outset would have been compounded by the fact that a majority, if not all, the popular articles that followed, between 1935 and 1939, took up the notion of tissue culture supporting the production of test-tube babies. Moreover, the ensuing slew of wild stories reinforced Fell's agitation at the exaggeration that surrounded tissue culture, for she was already inclined to pour scorn on those who inflated its potential. It was, in her eyes, '*merely a valuable technique* with peculiar advantages and peculiar limitations'.73 The hyperbole that led many to think otherwise was, she acknowledged, not merely the product of popular expectation, but also the result of the scientific dispute that enveloped the technique in its early years. Detailing precisely the disdain with which she viewed the hype surrounding the method, and acknowledging that much of this arose from her peers, Fell bemoaned that tissue culture:

> often suffers from its admirers. There is a kind of romance in the idea of being able to remove living cells from the body and watch their activities in a glass vessel . . . which sometimes causes imaginative people to express many extravagant claims and hopes which experience fails to justify, and which has sometimes impelled the more critically minded to regard the whole subject with suspicion.74

Brave New Worlds and Cultured Babies

Aside from *Daedalus* and the claims of Strangeways in the 1920s, one needs to look to other sources to ascertain exactly why the press coverage of tissue culture shifted from the articles that mainly focused on its medical potential to the darker 'Chemical Baby' pieces that began to plague Fell during the mid- to late 1930s. The most obvious source for this change in the articles' content and, crucially, tone, undoubtedly lies in Aldous Huxley's *Brave New World.* Published in 1932, this book offered a vision of a future dystopia where the contemporary climate of the late 1920s was satirized, partly by extrapolation to an age where rationalized Taylorist production was applied to all spheres of human activity. Crucially for this discussion, to give his satire a contemporary, yet undoubtedly futuristic

resonance, Huxley offered a world where humans themselves were now fashioned in bottles, on production lines reminiscent of those that brought forth the Model-T Ford. Although *Brave New World* was a far more multifarious vision of the future than *Daedalus*, with Huxley engaging with other factors of contemporary life, such as modern advertising and the rise of throwaway consumerism, its immediate impact appeared to further the popular fascination with ectogenetic babies, with the focus on its eerily prophetic '"nightmare vision" [of] babies in bottles'.75

Huxley undoubtedly drew upon much of the prevalent public sentiment surrounding 'bottle babies' to root his novel within contemporary fears about exactly where science was heading. Like Haldane, he saw biology as the centre of potential scientific progress and resolutely believed in communicating to a large public audience.76 Unlike his close friend, he was vocally disillusioned with the uses to which science was being put in his time.77 In this respect, he also differed from his elder brother, Julian, who, in 1927, also published a fictional account of tissue culture research. His 'The Tissue Culture King', which appeared in the science-fiction magazine, *Amazing Stories*, did not, however, concern itself with popular sentiment.78 It simply parodied the professional fascination with *in vitro* immortality at a time when the technique had yet to confer clinical benefit. *Brave New World*'s far more sinister portrayal of tissue culture's implications becomes manifest in the opening passage of the book, where the rational 'growth' of future generations is detailed, and its emotionally bereft 'manipulation' is laid bare, describing within three pages, the 'technique for preserving the excised ovary alive and actively developing'.79

Significantly, a quote from embryologist Joseph Needham may have induced reporters to claim that Honor Fell was overseeing the *in vitro* cultivation of humans. When a critic claimed that the biology Huxley envisaged was a remote possibility, founded on hearsay, Needham leapt to his defence, declaring:

> the biology is perfectly right, and Mr. Huxley has included nothing in his book but what might be regarded as a legitimate extrapolation from the knowledge and power we already have. Successful experiments are now even being made in the cultivation of embryos of small mammals *in vitro*, and one of the most horrible of Mr. Huxley's predictions, the production of numerous low-grade workers of precisely identical genetic constitution from one egg, is perfectly possible.80

Needham himself spent some time working at the SRL on embryo cultures with Waddington in the 1930s and, once again, we see evidence of a scientist wildly overstating the potential of tissue culture in a popular arena. This apparent scientific verification would appear to have pointed reporters in the direction of Fell's laboratory, whilst also giving them reason perhaps to disregard her protestations that no such work was taking place. As she stated in her 1935 letter to Henry Dale, 'the editor does not believe my denials, *in view of information he has received from elsewhere*'.81

Apparent authoritative verification for the SRL's growth of babies in bottles also lay behind another article on tissue culture, in the *Daily Express* on 16 March 1936. This piece, 'Woman Scientist Cultivates Life In Bottles', was, states Squier, probably written by the paper's long-time 'special correspondent', Charlotte Haldane.82 Haldane had more than a vested interest in this theme as her interest in *Daedalus* led her both to write a novel, *Man's World*, and to marry Haldane. The article dispenses with any hint of authenticity, and merely seeks to verify the assertion that the experiments of the SRL '*are the first steps to the brave new world visualized by Huxley, with babies cultivated in test tubes*'.83 Although Fell does feature in the article, it is only by way of description as an 'apologetic' young woman, clearly reluctant to co-operate.84 The report does end with some response from Fell's laboratory, but this is only an official statement, that rebukes the distorted claims of

ectogenetic growth, stating that tissue culture is 'merely valuable in attempts to analyse some of the complicated processes which occur in the human and animal body in both health and disease'.85 These denials, however, do nothing to shake the association between tissue culture and the capacity to engineer humans *in vitro*, as 'a scientist from another Cambridge lab' undermines the SRL's position by explicitly stating that: '*You should never ask scientists where their researches are leading. They don't know*'.86

Other press pieces followed in the same vein. In 1937, the *Daily Mirror* reported on the work of SRL researcher, Peter Matrinovitch, who cultured rat glands. Matrinovitch is, the article states, one of 'the cautious scientific men' who leave ideas of babies in bottles to the 'writer of fantasies'.87 Matrinovitch, 'being a serious biologist does not talk about bottle babies', we are told, but, nevertheless, 'science moves slowly in their general direction'.88 Once again, familiar conclusions are made about the particular avenues that biology was moving down, with work on cultures seen as one small step from growth of human babies, and the claims of scientists to the contrary seen as perfunctory. In the same year, demonstrating that the work of the SRL was attracting international attention, the *Daily Mail (Paris)* ran a story that again aptly demonstrates the sense of wonderment and foreboding that greeted tissue culture, proclaiming its readers would be 'fascinated—and perhaps a little frightened'.89

The final article assessed here details neatly how tissue culture was presented in the final years before the Second World War, showing that it was seen as a far less promising technique than at the turn of the century, or, indeed, the turn of the decade. This piece, 'Could You *Love* A Chemical Baby?' appeared again in *Tit-Bits* and marks the end of reporting on culture that was grounded in this climate of exaggeration. Recognizable themes appear from the outset: the works of Carrel, notably his immortal chick cells, are held as exemplars of the scientific progress at which, the author states, 'our minds stand aghast'.90 In a familiar twist, these chick cells, had they been allowed to grow, 'would by now be as big as the Alps!'.91

The 'unusual speciality' of the SRL then again becomes the focus of the report, but crucially, the familiar notion that such work is a step toward the creation of life is totally devoid of the sense of optimism that characterized earlier extrapolations from work on culture to humans. The section on *in vitro* life is ominously titled 'An End to Humanity?' and ponders whether 'these soulless creatures of chemistry [will] conquer the true human beings'.92 Exemplifying this shift in tone the article ends with Carrel's 'immortal' culture, once emblematic of the promise held by tissue culture, now representing something far more insidious, warning its readers to be mindful of 'that chicken heart that went on growing and growing . . .'.93

Conclusion

Tissue culture's early years in Britain do not sit well in long historical accounts of tissue procurement and popular opposition, and do much to refute such a framework. Paul Rabinow notes that the danger of reference to totalizing historical values and frameworks lies in their inability to apprehend new things. 'From time to time', he notes, 'new forms emerge which catalyse previously existing actors, things, temporalities or spatialities into a new mode of existence, a new assemblage.'94 Tissue culture is one such emergent form, and we must understand the events detailed herein as an interesting episode in their own right. This should not be as an extension of nineteenth-century grave-robbing controversies, nor as a precursor to modern tissue-retention scandals. As demonstrated, popular coverage of tissue culture in interwar Britain was free from prior, and our current, repugnance at the use of human and animal material. It was more concerned with the fantastical speculation that had

dogged appraisal of the emerging experimental science, especially biology, from the turn of the twentieth century.

Given their reputation as resolutely trashy, 'feather-brained'95 publications, sensational articles circulating in the media, such as *Tit-Bits*, may well appear to demean the validity of applying their contents to a study of early public appraisal of tissue culture. Two crucial facts must, however, be borne in mind here. First, *Tit-Bits* enjoyed enormous circulation figures and is as good a site as any, if not better than most, for gauging how the public would have perceived the technique, potential, and social ramifications of culturing tissue. Secondly, and crucially for the purpose of the argument that this hyperbole arose from scientists themselves, it was the editorial policy of journals such as *Tit-Bits* to merely condense and simplify news of interest for the public, not to fabricate their own sensational claims.96 As evidenced in the articles on tissue culture at the SRL, its editorial remit of combining education with titillation was achieved to the full by simply detailing some basic advances and then repeating the flamboyant claims of certain figures. Thus, behind the constant presentation of the technique as a miracle cure-all with 'stupendous possibilities' are the claims of a band of experimentalists eager to assert tissue culture's viability.97 In the later, more sinister, theme of ectogenetic humans, one sees the legacy of scientists' tendency to enter the realm of popular fascination, which immediately lent credence to the overstatement that enveloped tissue culture.

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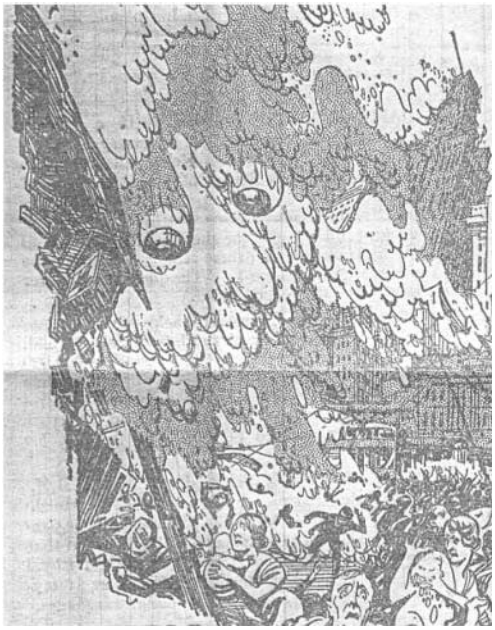

Fig. 1. The perceived latent threat of tissue culture.
Source: Tit-Bits, 3 December 1932.

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