BOOKS & ARTS

Immortality of a kind

The ability to grow human cells in the laboratory created paradoxes of personal identity.

Culturing Life: How Cells Became Technologies
by Hannah Landecker
Harvard University Press: 2007. 276 pp.
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Nick Hopwood

In the flood of instant comment on cloning and stem cells, we need the longer and deeper views of cellular technologies that only history can provide. Historians of science have written much about the nineteenth-century advent of cell theory, but genes and molecules stole the limelight in the twentieth. We have a first-hand account of the history of somatic-cell genetics (*The Cells of the Body* by Henry Harris; Cold Spring Harbor Laboratory Press, 1995), a rich study of the adoption of the electron microscope (Nicolas Rasmussen's *Picture Control*; Stanford University Press, 1997), and a philosophically driven interpretation of the rise of cell biology (*Discovering Cell Mechanisms* by William Bechtel; Cambridge University Press, 2006). But there has been no extended history of tissue culture — the technique, which underpins most biomedicine today, for growing vertebrate cells in the laboratory as if they were independent microorganisms. With five chapters tackling key episodes up to 1970, *Culturing Life* by Hannah Landecker is a small book that does much to fill that large gap.

Landecker adopts a powerful approach from recent science studies: she takes routine practices of observation and manipulation very seriously indeed. This might sound dull, and not everyone would choose to spend years poring over methods sections and manuals. What converts base method into golden insight is the anthropologist's eye for the strangeness, and thus the historical significance, of techniques that practitioners soon took for granted. Landecker identifies fascinating novelties in the autonomy, plasticity and time relations of cultured cells. She shows how, long before Dolly was born, such mundane technologies as flasks, tubes, nutrient media, freezers and culture collections created radically new and challenging forms of life.

Tissue culture was pioneered in the early twentieth century by scientists frustrated with 'fix, slice and stain' histology and its obligatory detour via the cadaver. To solve difficult problems — the process of nerve outgrowth and the origin of the heartbeat — they learned from bacteriology how to culture living cells outside the body and so see them more directly. Observation was still highly mediated. Landecker reveals how time-lapse microcinematography made once-static entities move and change.

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Life in the lab: the ability to store and culture human cells led to the creation of the HeLa cell line.

The drive to manipulate cells *in vitro* was about distinguishing inherent limits from technical obstacles that could be overcome. Yes, cells could divide, it was soon shown, but for how long? Between the world wars, the French-American surgeon Alexis Carrel sensationally claimed immortality. Wide audiences were told that, with enough food, his culture of chick embryo cells would grow larger than the Sun. He was believed, Landecker suggests, because his claim fit with a prevalent ideal of biological engineering. It would be interesting to go further and explore how, in the era of testicular transplants to restore the failing powers of rich old men, cellular immortality was bound up with the whole-organism biology of death, ageing and rejuvenation.

Carrel was plausible because experiments were restricted to a few laboratories with their own distinctive cultures, in every sense. After the Second World War, the campaign to mass-produce polio vaccine led to tissue culture being practised on a far larger scale and applied to the previously recalcitrant human cells. Techniques and reagents were standardized, and so, like other model organisms, were the cells. Freezing and clonal cultures promoted the distribution of established lines and liberated cells and researchers from the constraints of space and time. Life could now be started, stopped, stored, split and its different stages juxtaposed. With the finding that normal somatic cells can divide only a fixed number of times, Carrel's claim of cellular immortality was rejected, but some cells and some people still achieved immortality of a kind.

Landecker interprets the various stories about Henrietta Lacks — a black American who died of cervical cancer not knowing that her biopsy had been turned into the permanent HeLa cell line — as attempts to negotiate the paradoxes of personal identity in the biomedical age. Optimism in the 1950s about having a laboratory afterlife of service to science gave way in the late 1960s and 1970s to racially charged fears of contamination with these by then ubiquitous cells; now, bioethical tales of overdue recognition are dominant. Landecker brings out the Lacks stories' obsession with 'what she would weigh today' — the unsettling phenomenon that more living, reproducing matter has been generated from a body than it ever contained.

Lay readers will appreciate the effort that kept Landecker's scholarly and original book short and accessible. There is inevitably more for specialist historians to do. The epilogue, which interprets the cloning of adult mammals as dependent on freezing and synchronizing cells, whets the appetite for a fuller discussion of cell-cycle work. It also raises the larger question of how the histories of somatic cells and of gametes have intertwined. Answering it, and more generally gaining a sense of the place and status of cell culture in biology, would have taken the book beyond journal and newspaper articles to the realm of textbooks and other synthetic works. But these are suggestions for research that happily can now build on Landecker's stimulating reconstruction of the cultures that gave us cultured cells. ■

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A scientific symphony

Harmonious Triads: Physicists, Musicians, and Instrument Makers in Nineteenth-Century Germany
by Myles W. Jackson
MIT Press: 2006. 368 pp. $40, £25.95

Peter Pesic

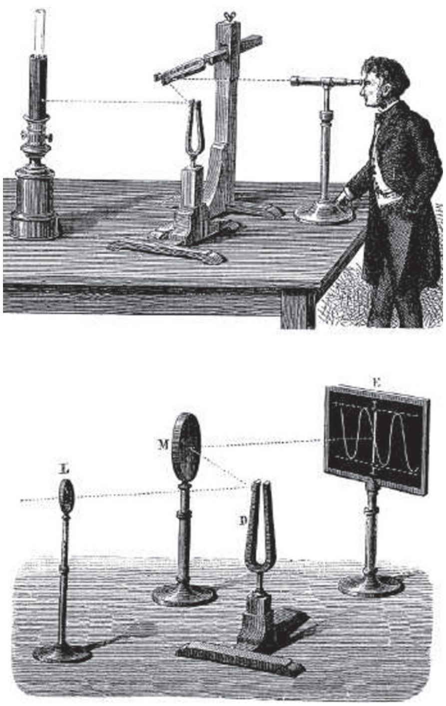
Why are so many scientists musical and so many musicians scientific? This relationship goes back to antiquity, but remains largely unexplored. In his book *Harmonious Triads*, Myles Jackson, a historian of science and an accomplished cellist, examines nineteenth-century Germany, where science and music interacted with particular intensity.

He begins with the physicist Ernst Chladni, who in the 1780s sprinkled sand on vibrating plates to produce fascinating images of wave motion. Jackson relates this exemplary demonstration to Chladni's novel musical instruments (have you heard of his euphone or clavicylinder?). These instruments were informed by the physics of vibrating bodies, which had both musical and commercial possibilities. But musical observations also informed science: for example, Chladni's production of longitudinal vibrations led to the intensive study of their properties, which was crucial for the development of wave theory.

Chladni considered his demonstrations not entertainment but *Bildung*, the quest for education and personal edification so important in German thought. Likewise, Jackson depicts German scientists and physicians using choral singing as a central unifying activity at their meetings, celebrating their camaraderie while augmenting their musicality and fuelling their patriotism. Alexander von Humboldt once invited the composer Felix Mendelssohn to write a festive cantata, which you can hear on the book's website (http://mitpress.mit.edu). Why do our scientific meetings no longer include 'singing savants'?

Music celebrated science, but the conflict between organic and mechanical views lay behind Goethe's distrust of newtonian science, as well as the musical automata animating E. T. A. Hoffmann's unforgettable stories. Nothing less than the soul was at stake: Jackson emphasizes that "audiences did not want to be entertained; they now wished to be moved". Accordingly, builders sought to make pipe organs more expressive by enabling them to swell in volume, despite the difficulty of making the sound louder without its pitch rising. This problem led physicist Wilhelm Weber and others to important research on the speed of sound and the specific heat of various gases. By then, however, the taste for expressively swelling reed organs had (mercifully) diminished.

In the process, both musical and physical developments had led to an ever-increasing emphasis on precision and standardization. Jackson's description of the struggle over an international pitch for concerts discloses a whole *comédie humaine*. Who would tune the concert of Europe? Each nation vied for pre-eminence by insisting on its own pitch standard, from Paris (where A above middle C was tuned to 435 Hz) to London (A455); by comparison, Mozart's own tuning fork sounded A422. An international conference convened in Vienna in 1885 chose the Parisian pitch, using arguments guided more by diplomatic finesse than musical purity. As one contemporary musician put it, using a higher pitch standard destroyed the "effect and character of ancient music — of the masterpieces of Mozart, Gluck, and Beethoven", who expected a lower pitch standard and did not wish their singers to strain a semitone past the pitches they had intended. Recent 'authentic' performances at the older, lower pitch standard have tried to reverse this trend.



Sound idea: Jules Lissajous used light and mirrors to increase the precision of tuning forks.

Small comfort, then, that these new tuning forks were regulated by the research of physicists Jules Lissajous and Josef Stefan. Nor was the imposition of equal temperament (artificially equalizing the size of all semitones) an unmitigated boon, despite its simplicity and advantages in scientific eyes. Jackson's account of "the fetish of precision" in temperament describes how Johann Heinrich Scheibler and others produced increasingly accurate forks that enabled the tuning of keyboard instruments with unprecedented precision. This erased the earlier unequal temperaments used by J. S. Bach and his successors, in which each key had an individual character.

No less controversial was the development of the metronome. At first Antonio Salieri hailed the machine as "the true interpreter of the ideas and feelings of every composer". But soon its mechanical rigidity seemed only "a dumb thing; one must feel the tempi," as Beethoven put it.

At least the metronome could drill novices into developing a steady beat. Jackson concludes with the parallel development of other pedagogic torture devices that held a piano student's hand in the correct position using guide rails, such as Johann Bernhard Logier's chiroplast. These increasingly popular mechanical aids accompanied the spread of piano-playing as an indispensible bourgeois accomplishment, along with an idea of virtuosity that encompassed sheer speed, rather than depth of expression. Jackson concludes with *fin de siècle* controversies over how a pianist touching a key can create ineffable results beyond the scope of a mere mechanism.

Jackson brings forward both harmony and tension between science and music, for "the freedom of the individual to cultivate his or her own character and taste, the role of the State in defining those attributes, and the relationship between the organic and the mechanical were at stake." MIT Press should be commended for producing this beautiful volume. Jackson's outstanding book is an essential source for everyone interested in the relationship between music, technology and science. ■

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