The evolution of tissue culture

Culturing Life: How Cells Became Technologies

Hannah Landecker

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Reviewed by Kendall L Knight

Tissue culture is the most fundamental technique in any mammalian cell biologist's toolbox. Anything we hope to learn about the molecular intricacies of cellular life begins in the tissue culture hood. But at what point in the history of science did tissue culture become an accepted method, and how did its arrival affect scientific discovery and productivity? Hannah Landecker provides a wonderful assortment of descriptions of experimental design, 'eureka'-type moments in the lab and the scientists responsible for initiating this new technology during the early 1900s, along with its evolution to the present. After an overview of how the narrative is tied together, the stage is set in the first chapter with captivating descriptions of Ross Harrison's studies of nerve cell cultures (1907–1910). At the time, histological examination of tissue sections was the method from which a temporal appreciation of nerve growth could be surmised. However, with Harrison's work the growth of independent living nerve cells could be observed in real time, thus marking the beginning of tissue culture as a legitimate scientific technology.

Together with Harrison, Alexis Carrel serves as a foundation for Landecker's narrative. Carrel was a controversial figure, on the one hand a brilliant surgeon who earned the 1912 Nobel Prize in Physiology or Medicine, on the other a social extremist for his advocacy of eugenics. Landecker avoids discussion of this latter aspect of Carrel's life, a justifiable exclusion given the inevitable distraction from her positive focus on the development of cell culture. Carrel's surgical expertise brought a vast array of technical insights to the developing field of tissue culture, and, together with colleague Montrose Burrows, he provided an important transition in early cell culture technology —the ability to pass cells from one culture to the next without needing to extract cells from the original organism. Inspired by his earlier work on wound healing, Carrel also discovered that addition of 'embryo juice', precursor to the modern day yet still mysterious 'fetal bovine serum', was crucial to robust growth of cultured cells. His technical advances moved cell growth in culture toward the realm of immortality.

Landecker next moves to a main thrust of the book, the industrialization of tissue culture. This resulted from the intersection of this burgeoning field with virology, a convergence accelerated by the critical need for mass reproduction of cells infected with poliomyelitis virus. Landecker nicely sets the tone of the era with portrayals of the social context pushing improvements to tissue culture methodologies and of scientists such as George and Margaret Gey, whose studies of cervical cancer established the benchmark cell line, HeLa. Unfortunately, the reader is given the impression that HeLa was the cell line of choice for production of the polio vaccine, when in fact monkey kidney cells were most frequently used. This omission may have been intentional to avoid discussion of the controversy over contamination of early polio vaccine preparations, but a disclaimer could have been included.

The underlying theme of biological and cellular plasticity is particularly well highlighted in descriptions of the creation of hybrid cell lines. Fusion of cells from different species created quite a stir and showed great promise for genetic studies without the requisite sexual breeding, an idea brought forth by Boris Ephrussi. However, the early 1970s marked the beginning of recombinant DNA methods, which defused enthusiasm for cell fusion as a useful genetic method. But as Landecker correctly emphasizes, despite losing out to recombinant methods, cell fusion firmly established the plasticity of cells and served as another important landmark in redefining cellular and organismal boundaries.

Given the complexities of biological science in the 21st century and the inter-relatedness of its many aspects, for example, cloning, stem cell research, etc., Landecker makes it clear that this narrative focuses on tissue culture and justifiably argues that its history describes the evolution of an approach from which many related technologies have developed and will develop. Thus, she reiterates a classic appreciation of new discoveries—they open up previously unimagined avenues for research.

In the epilogue, Landecker ventures into social and philosophical considerations of the relationship between the ever evolving nature of biotechnology and human life; as she turns it, the relationship between biotechnology and being biological. With this, she argues that the development of biotechnology in the 20th century is best described "as the increasing realization and exploration of the plasticity of living matter." The history told in this book certainly supports this contention.

Overall, Landecker's narrative flows very nicely, and appropriate citations throughout the text, with inclusion of small commentaries in the Notes section, assist the reader in appreciating the temporal appearance of new scientific revelations and their relationship to both scientific knowledge and societal circumstances. As any good narrative should do, this book inspired me to search further into some of the historical details about both the scientists engaged in creating this new technology, as well as the origins of the technical details themselves.

Well-written historical accounts of scientific discovery allow the reader to appreciate the adversities confronting the scientists involved and the circumstances that drove their discoveries and to wonder what may happen next. *Culturing Life* is no exception. As unexpected as some of the early 20th century observations may have been that led to the current technology of tissue culture, further development of both our understanding of biological systems and our ability to manipulate them undoubtedly has more than a few surprises in store.

Kendall L. Knight is Professor of Biochemistry & Molecular Pharmacology at University of Massachusetts Medical School Worcester, 364 Plantation Street, Worcester, Massachusetts 01605, USA.
e-mail: kendall.knight@umassmed.edu