



The conclusion ends by discussing continuing areas of research in comparative animal physiology, such as evolutionary and developmental physiology (dissertation topics for future historians), revealing how active this world of study still is. Yet, as Anctil notes, despite manifold animals who adapted admirably to life within extreme environments, physiologists today spend much of their time focusing on animal responses to human-made environmental destruction. He ends with optimism that this condition will be reversed, allowing continued appreciation of the beauty of animals at work. We, his readers, join heartily in this hope.

doi:10.1017/S0007087424000025

Karl S. Matlin, *Crossing the Boundaries of Life: Günter Blobel and the Origins of Molecular Cell Biology*

**Chicago: University of Chicago Press, 2022. Pp. 368.
ISBN 978-0-226-81934-1. \$105.00 (cloth).**

Nathan Crowe

University of North Carolina, Wilmington

At first glance, Karl Matlin's *Crossing the Boundaries of Life* appears to be a straightforward history of the emergence and impact of Günter Blobel's work on cell signaling pathways. Carried out in the 1970s, Blobel's experiments articulated how cellular parts functioned within the cell, linking specific proteins and their activity to localized cell organelles. The profundity of the work earned Blobel the Nobel Prize in 1999. How Blobel uncovered these mechanisms, which involved generating new experimental designs such as the cell-free assay and linking the activity of cell parts with the products they generated, is certainly deserving of a detailed historical analysis, and motivates much of the narrative in the book. However, Matlin has bigger ambitions than simply tracing the genesis and impact of Blobel's discoveries. Rather, Matlin suggests that a close analysis of Blobel's work and its influence, which retained a vision of the cell as a whole while articulating the functions of proteins acting within them, undermines the post-Second World War narratives that have given primacy to the rise and importance of molecular biology. Instead, he argues that molecular cell biology, which practised a new way of approaching and uncovering cellular mechanisms, transformed much of the biological sciences, many of which still retain the essential epistemic practices that Blobel perfected. In doing so, Matlin makes the case that cell biology, not molecular biology, should be seen as having most enduring legacy of the twentieth-century biological sciences.

Crossing Boundaries is divided in ten chapters grouped into three unequal parts. The first three chapters make up Part 1, 'The cytologist's dilemma', which sets up the problems of linking form, function and the essence of life within the cell itself. Part 2 comprises Chapters 4 to 8, and traces how cytologists moved from examining cells as wholes to teasing out how cell organelles and associated molecules worked within the cell itself. The final two chapters and the epilogue are grouped into the third part, 'Form redux', which not only outlines the ways in which Blobel's approach can still be found in

contemporary biological sciences, such as systems biology, but also explores more explicitly the philosophical implications of the book.

Though broken into three parts, the book in many ways is structured like an hourglass. The first chapter is broad, going back as far as the work of Robert Hooke in the seventeenth century to help lay out the larger conceptual problems that biologists encountered as they tried to articulate what differentiates cells as living things. Matlin moves quickly through the centuries and by the middle of Chapter 2 readers find themselves following how insights into protein folding during the 1930s and 1940s helped advance an understanding of cell membranes. The hourglass continues to funnel the reader to Chapter 5, touching on the breakthroughs in electron microscopy along the way, where Blobel is formally introduced. In this chapter, Matlin carefully breaks down how the multiple strands of cytology, microscopy and biochemistry articulated in the previous chapters fed into a new form of experimental practice. Though Matlin traces the emergence of proto-forms of this approach as far back as the 1940s (Chapter 3), he shows how the new methods of what can be called molecular cell biology fully matured in Blobel's work as his lab work connected protein structure, activity and cell organelles in deciphering cell signalling pathways. Matlin then uses the following chapters to show how Blobel's approach became integrated into many other laboratories and a model for how to work out the molecular biology of life.

Crossing the Boundaries of Life also exemplifies some of the major challenges of writing the history of science in second half of the twentieth century, particularly for anyone interested in the theoretical and experimental changes that emerged. Over the course of the century, many biological sciences become extremely complex, and following these fields often results in highly technical and dense narratives. *Crossing Boundaries* does not shy away from this reality, though Matlin, who spent most of his career as a practising cell biologist, and in fact did his postdoctoral work across the hall from Blobel's laboratory, does a laudable job in unpacking and explicating where the crucial moments of innovation occur. Matlin's narrative also adeptly ties together many strands of the twentieth-century biosciences, most of which have only previously been outlined in disciplinary histories. Though molecular cell biology may sound like it only concerns a small slice of biological problems, *Crossing Boundaries* features an array of work from protein chemists, embryologists, molecular biologists, physiologists and, of course, cytologists. Matlin underpins his philosophical analysis using Hans-Jörg Rheinberger's concept of epistemic things and readers who found Rheinberger's work informative will find *Crossing Boundaries* to be an exceptional example of how it can be used to understand the work of modern biological sciences.

Tracing the relevant intellectual and experimental threads takes time and space, however, and likely to keep the book manageable Matlin does not explore many of the contexts in which those ideas were imbedded. For instance, much of the work that Matlin focuses on was carried out at the Rockefeller University (and its earlier instantiation as the Rockefeller Institute), but the institutional contexts provide background at best. Similarly, how the social and political dynamics of funding for biological sciences after the Second World War might have played into the successes of Blobel's experimental programme never comes up. This is likely a function of sources, too. Matlin's narrative is mainly driven by the sequence of scientific papers produced by these groups and by the many oral histories he carried out with the major actors, such as Blobel himself.

The highly technical nature of the narrative will also likely discourage readers who are unfamiliar with modern cell and molecular biology and make it difficult for readers other than historians of modern biology to differentiate between the epistemic realities of molecular biology and molecular cell biology. However, for historians of twentieth-century biology, *Crossing Boundaries* successfully makes the case for a more sophisticated

understanding of the most persistent structures of post-Second World War biosciences. Gone are the days in which molecular biology can be given broad primacy as *the* transformative agent of change in the second half of the twentieth century. Instead, Matlin's work argues that we should be looking more carefully at the experimental approaches that emerged in this period. The hyper-reductionism of molecular biology ultimately was not nearly as successful at understanding the biology of life as the way cell biologists deployed molecular techniques in a more contextually sophisticated epistemic approach that still resonates to this day.

doi:10.1017/S0007087424000141

Amanda Lanzillo, Pious Labour: Islam, Artisanry, and Technology in Colonial India

Berkeley: University of California Press, 2024. Pp. 246. ISBN 978-0-520-39857-3. £30.00 (paperback).

Nikhil Joseph Dharan

University of Pennsylvania

Technical manuals are curious historical sources. The insight they offer into processes and technologies of artisanal creation can certainly be valuable, but as storytelling devices these texts confound historians by how much they do not say. In *Pious Labour*, Amanda Lanzillo reads vernacular manuals and community histories from colonial north India (nineteenth to twentieth centuries) as exemplary sources for understanding religion, class and their intersections with artisan identity during industrialization. Whereas scholars have shown the importance of small workshops and local production in relation to the factory, the author uses her unique evidence base to paint a picture of distinct labouring communities, combing both colonial and small community archives to elucidate the broader context for labour, technology and the technical authority of Muslim artisans. Lanzillo responds to Projit Mukharji's call in *Doctoring Traditions* (2016) for understanding the 'braiding' of science and other kinds of knowledge by demonstrating how knowledge and Muslim artisan identity change in relation to one another.

The author deliberately refuses to disentangle the technical and religious practices of Muslim artisans, instead using her cases to ask bold questions about both the importance of piety for artisanal production and the crucial role class and labour have played in the history of Islam in South Asia. Lanzillo's analysis is sharpest in attending to class hierarchies within the South Asian Muslim community, highlighting how artisans contested encroachments on their practices and knowledge authority. The chapters of *Pious Labour* are fascinating intellectual journeys, utilizing a wealth of primary and secondary material to render artisan life as vividly as possible, putting texts into context with an almost ethnographic sensibility.

The first chapter addresses the labour of lithography; that is, the work of artisans in both government and community presses. Lanzillo places press workers in the context of scribal cultures, the language traditions of Islamate South Asia, and the genesis of Indian newspapers and presses. This history is brought up to the late colonial period