Preface

THE SURREALISTIC MASTERPIECE PAINTED by Salvador Dalí in 1931, *The Persistence of Memory*, provides a popular image for publications and meetings on immunological memory because of its title (Ahmed and Rouse 2006). In 1954, Dalí recreated this work by "digitizing" or fragmenting homogenous elements of his original painting and called it *The Disintegration of the Persistence of Memory*. Dalí was, of course, not thinking about immunological memory. The original painting is interpreted to symbolize the relativity of time and space, and the recreated image acknowledges the new physics of quantum mechanics. In the first half of the twentieth century, standard particle physics gave rise to quantum mechanics. This accompanied a transition from the Bohr atomic model whereby electrons occupied discrete orbits, to an electron cloud model that described electrons within a probabilistic distribution that only approximated Bohr's orbits. This evolution was not without scientific challenges and challengers; Albert Einstein was notably not an ardent supporter despite his contributions to the theory's development (Becker 2018). Current events in T-cell immunology may have some parallels, and we have chosen Dalí's 1954 painting as the cover image for this book, *T-Cell Memory*.

Studies in the early twenty-first century, catalyzed by the availability of reagents for detecting antigen-specific cells directly ex vivo, fluorescent antibodies, and four-color flow cytometry, revealed heterogeneity among activated and memory T cells. This initially inspired relatively simple models that lumped T cells into a small number of discrete subsets. This was an important development in the field, but the biology never conformed uniformly to the model and debates raged over developmental relationships between subsets and which flavor of memory T cell was best suited to a particular task. Increasingly powerful tools now permit the capture of many parameters at the protein, transcriptional, and epigenetic levels. This has resulted in a trove of data that paints a more digitized reality of T-cell differentiation states. Individual T cells exhibit a spectrum of gene expression patterns and epigenetic imprinting. This has led to the ad hoc invention of new subsets, subsets of subsets, and questions about what features of cells best define inclusion within a proposed class. Conceptualizing T-cell heterogeneity, and relating it to ontogeny, developmental potential, and function, is one of the major tasks for immunology today. And we do believe in the persistence of immune memory—our goal is not the "disintegration" of T-cell memory but to provide a better understanding of it. We hope this proves more tractable and intellectually accessible than quantum mechanics.

This book provides contemporary summaries of the state-of-the-art in focused areas including differentiation, tissue distribution, homeostasis, and durability of T-cell memory. Authors also wrestled with the challenges of nomenclature and classification in a world of increasingly granular description of individual T cells. Twenty-two chapters were commissioned, representing 69 authors, to capture a breadth of expertise and a diversity of perspectives. This collection was prepared during the global COVID-19 pandemic, a salient reminder of the importance of immunology to modern society. We hope the reader finds this collective work as informative and thought provoking as we did.

DAVID MASOPUST
RAFI AHMED

REFERENCES

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