

## Preface

**B**ECAUSE THIS IS THE FOURTH EDITION OF THIS BOOK, it seems appropriate to look back to the origins of the project and to acknowledge the many individuals and organizations that have contributed. Such memories of the past are not stored in our brains like computer files but must rather be reconstituted each time we recall, making them prone to fade and/or “mutate” over time. But since the 1990s, we have archived e-mails and other electronic records to cross-check if our memories are accurate. Digging through such archives and contacting various people, I was able to reconstitute a reasonably accurate (although likely incomplete) history below.

Until the 1970s, the study of biological systems included equal attention to all major classes of macromolecules: nucleic acids, proteins, lipids, and glycans. But by the end of the 1980s, most popular books, monographs, and manuals about Molecular Biology had a strong emphasis on DNA, RNA, and proteins, with some attention to lipids, but effectively leaving out glycans, which were poorly understood, far more complex, diverse, and difficult to study. This anomaly also affected the popular *Current Protocols in Molecular Biology*, established in 1987 by experts at Harvard, in collaboration with Sarah Greene of Greene Publishing Associates. But one of the editors (the late John Smith, who was biochemically inclined) proposed to the board a chapter about glycans. Apparently, this proposal came after discussions with John Coligan at NIH (later an editor of *Current Protocols in Immunology*). The outcome was a series of Units on Preparation and Analysis of Glycoconjugates, led by Adriana Manzi, Hud Freeze, and myself and coordinated by Kaaren Janssen as the Series Editor.

By the 1990s, the now somewhat segregated minority of scientists working primarily on glycans had embraced Raymond Dwek’s term “Glycobiology” and a Society and Journal of the same name followed. At UC San Diego, a small group of aficionados had formed a Glycobiology Program within the UCSD Cancer Center and, along with the Division of Cellular and Molecular Medicine (created by George Palade and Marilyn Farquhar), recruited Jamey Marth and then Jeff Esko—while also collaborating with a parallel program at the La Jolla Cancer Research Foundation (now Sanford Burnham Prebys) to organize an annual San Diego Glycobiology Symposium. A graduate-level, elective course entitled “Essentials of Glycobiology” had already been taught at UCSD for many years, and it seemed logical to convert it into a textbook. In a December 23, 1996 e-mail to the Glycobiology Program members, I wrote that “[w]hile I was at the GlycoImmunology meeting in Greece, I had a long talk with Jerry Hart and Rick Cummings about their proposed Glycobiology Book. They were interested in the possibility of combining forces with our group to do a Glycobiology course and produce a book in 1998.” Working together, we were able to put together a “Consortium of Glycobiology Editors” (CGE) who proposed a graduate-level textbook called *Essentials of Glycobiology*.

In looking for a publisher, we had the advantage of the prior connection with Kaaren Janssen (mentioned above), who was now at Cold Spring Harbor Laboratory Press (CSHLP), and who introduced us to John Inglis, the Executive Director of the Press. After considering some options, it was an easy choice to make an agreement with the highly prestigious and nonprofit CSHLP. An additional major consideration was John’s forward-thinking willingness to consider our rather unusual request: to make the entire book freely available for online searching and reading. This first-of-its-kind example for a major textbook was possible because of yet another coincidence—I had just finished a stint as Editor in Chief of the *Journal of Clinical Investigation* (JCI), during which we took advantage of the online presentation of the journal (a new concept) to also make it free to all readers. This approach was later called “open access.”

The success of the JCI experiment generated an invitation to the PubMed Central Advisory Committee from David Lipman, then the new Director of the National Center for Biotechnology Information (NCBI) of the National Library of Medicine—the home of GenBank, PubMed, and many other free online bioinformatic resources. Lipman did not hesitate to accept a proposal from the editors and CSHLP to make the entire book freely available at NCBI Bookshelf for searching and reading by anyone anywhere in the world with an internet connection—eventually including downloadable slides for each figure. Jo McEntyre (followed by Marilu Hoeppner) at NCBI worked closely with the Press and the editors to make this all possible. Since the recent departure of Lipman from NCBI, we were fortunate that the NCBI leaders who followed (Jim Ostell and now Steve Sherry) have continued their support of the online version. Although the Office of the NIH Director later considered supporting the effort, they could not do so without a national competition, and an anonymous donor stepped in to help the Press partially absorb the costs. But the editorial “office” still needed administrative support. Fortunately, a long-standing, glycobiology-focused program project from the National Heart, Lung, and Blood Institute (NHLBI) to members of the UCSD Glycobiology Research and Training Center (GRTC; co-directed by Jeff Esko and myself) could be used to support such efforts, followed by the NHLBI Programs of Excellence in Glycosciences (2011–2019), and then a National Career Development Consortium for Excellence in Glycosciences (K12, 2018–2023), which focused on immersive postdoctoral training in all aspects of glycosciences. All NHLBI support for these programs (and hence for the book) was spearheaded by program officer Rita Sarkar, without whose dedication and relentless support none of this would have happened.

As with the last edition, the editors of the CGE (now registered as a U.S. nonprofit association) have agreed to do this work purely as a service to the scientific community and will not be accepting any personal income from the book. Rather, we will be assigning any remaining income, after covering production costs, to further the impact of the book in the glycoscience community. Editors of the earlier editions have agreed to forward residual income from that edition toward the same goal.

Two other spinoffs that the NCBI supported with the third edition are now independently run by internationally representative committees: the NCBI Glycans Page (led now by Natasha Zachara) and the Symbol Nomenclature for Glycans (SNFG; led now by Sriram Neelamegham). Another special feature of the book has been the outstanding artwork executed largely by Rick Cummings (in this and all previous editions) and the downloadable slides of all figures. Special thanks also to Lorenzo Casalino and Rommie Amaro for the images of the COVID spike protein on the front cover of this edition.

Over the four editions, we have had progressive improvements in gender balance among editors and coauthors from the first to the current edition (from 8% to 39% female), the total number of editor and coauthors (from 13 to 131 participants), and in international participation (from 8% to 56%). Usage statistics from NCBI indicate access by almost 2,036,226 unique IP addresses in 2,213,203 sessions since 2011. Many kudos are due to the CSHLP Team (Denise Weiss, Kathleen Bubbeo, Inez Sialiano, Carol Brown, and Mala Mazzullo), the NCBI Bookshelf team (Stacy Lathrop, Kim Pruitt, Susan Douglas, Diana Jordan, and Jeff Beck), Evan Bolton at PubChem, and last but definitely not least, Amanda Cuervo, the “Glycobook Administrator” at the UCSD GRTC, who coordinated everything.

Most editors of this fourth edition are “Boomers” like me and will likely not be involved in the next one. Thus, the future of the book, and the field, will be determined by a younger generation of aficionados such as those we have recruited as coauthors in the current edition. We hope they will complete the process of reintroducing glycans back into the mainstream of “molecular biology.”

Ajit Varki

*for the Consortium of Glycobiology Authors*