"Still in Process": Collaborative Authorship in a Twentieth-Century Biomedical Textbook

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Although drama and film rely on collaboration, the arts can otherwise be a solitary endeavor. We think of the painter, the composer, the writer withdrawing to the studio or loft or room apart, as Alphonse Daudet withdrew to his windmill for the Lettres. In the past, science too could be pursued alone. Newton and Darwin were great individualists and discoverers: their works had single authorship. But in modern times, with new techniques that result in vastly accumulating data, science must now be a collaborative endeavor. Only the many fragments will lead to the whole.

This increasing reliance on collaboration in the work of science is expanding to the multiple authorships of science textbooks which, like evolution itself, must change with the new developments, and so undergo regularly rewritten editions. The following is my account of tracing a unique and close collaboration between six outstanding scientists—a Canadian, two Americans, three British. They lived together over periods of time in order to forge a coherent, lucid, readable text for university students on cell biology with a molecular approach. Their book has had a profound influence on pedagogy and communication in their field. But, as with Chaucer's pilgrims, a motley crew travelling in close quarters, the journey itself was full of humor, exhaustion, cynicism, faith, hard work, argument, discovery, and a shared experience that made it real and satisfying.

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"Textbooks must be beautiful and work well," editor Miranda Robertson said to me one evening in London. Molecular Biology of the Cell has proven to be such a book. In content, strategies, and goals it broke new ground when it appeared in 1983. New techniques of analysis at a molecular level had opened up a vast new world of data, and cell biology was about to prove a crucial, central, pivotal discipline. It would now be possible to elicit the principles by which all cells function. Yet there had been so far no textbook to explore and define these principles in the new molecular context. Working in close collaboration, its six authors strove to do just that for the undergraduate science and medical student. They put an enormous effort into it to achieve clarity, consistency, readability, and accuracy.

Students and professors responded immediately. It became a landmark textbook. Sales approached nearly 200,000 in the first three years and have maintained a high success since. The text was translated into six languages; and in each of the ensuing editions the group welcomed critical response in order to produce a "better" book each time, along with an accompanying The Problems Book, and, later, TextStack, a full software version, HyperCell, a rendering in animation, and, the latest, MBcC3 Kinemages, full-color, three-dimensional illustrations in motion. (In this case, the other fastest growing field of science—computer technology—was engaged.)

We look at such big books (over 1,100 pages in this case), we use them, we marvel at their presentation, and we wonder how they come to be written. I undertook to find out for Molecular Biology of the Cell, and the following discussion describes how and why I went about my project. In it I also comment on the process of writing my own "book about the book." This is therefore a highly personal account, but despite and because of this it may give insights into doing contemporary book history—that is, how one goes about this history when the authors are living, active, and still producing editions of the book.

Molecular Biology of the Cell had been conceived by James Watson as far back as the late 1960s and early 1970s while working on his text Molecular Biology of the Gene. He saw "that molecular biology was at the forefront of science and that the curriculum was on the verge of changing," but that the field had no textbook to guide and define it. Nor was he envisioning another traditional text. His idea was for a bold, fresh approach, yet at the same time one that was comprehensive and cohesive. He was aware as well that the making of such a scientific text is challenged by the progressive nature of the field: in the time it takes to write, edit, and publish, the content of the text becomes outdated, unlike the enduring original "text" which is the primary subject of study.
in the humanities. More so today than ever, then, because of the acceleration of the rate of discoveries in a scientific field, collaborative methods necessary for embodying and disseminating these were calling for new models of authorship.

Watson thought and talked with others about this for some time, having been encouraged earlier by Neil Patterson, a "book finder" for various firms that included both Worth and Garland Publishing. When, in 1977, Gavin Borden, president of Garland, saw the possibilities and the merit for the project, this small group, with others suggested by Watson, met in London; the group included immunologist Martin Raff of University College, London, and plant scientist Keith Roberts of the John Innes Institute, Norwich, the latter of whom in his student days had done the illustrations for Watson's *Molecular Biology of the Gene*. Next, at the invitation of Watson and Raff, Bruce Alberts, then professor of biophysics and biochemistry at the University of California, San Francisco, joined Raff and Roberts for a short summer session in 1978 at Watson's house on Martha's Vineyard. Together Alberts and Raff discovered the excitement of working closely, learning from each other, trying a fresh and cohesive approach that always linked facts to ideas and stories, and seeing how Roberts' drawings could clarify and lighten the text—all for the benefit of the student reader. *What Molecular Biology of the Cell* aspired to achieve in writing, it also strove to accomplish with drawing—after all, the subject matter is physical. Thus, as work progressed, Roberts would become less involved as a writer, to concentrate his talents on visual representation. Working closely with each author, he drew clear, simple illustrations that rendered information more accessible.

The book meetings continued through short winter sessions, in time snatched from demanding jobs and growing families, as well as through longer summer ones. The summer of 1979 was spent by the authors and their families at Fort Hill near Cold Spring Harbor. There were various other potential team members and chapters from outsiders, most of which were discarded because they did not fit the kind of tapestry the authors hoped to weave. However, when the others had read the wonderful chapter on developmental biology by Julian Lewis, then at King's College, London, which he had co-authored with a colleague, they immediately asked him to join the group. Finally, Dennis Bray, then also of King's College, London, whose field was the cytoskeleton, was the last primary author to complete the team, filling a spot which two others had left. Before the first edition in 1983, Norwich (1980), Manhattan (1981), and London (1982) were to be the other summer places where the group would cohabit in order to talk, read, consult, write, argue, edit each other's scripts closely and many times, and
send the results out to experts for opinion and correction. The Garland Publishing team headed by Gavin Borden included Miranda Robertson as London editor, who played a major part both in the editing and in obtaining advice from students and professors in trial readings, and Ruth Adams as New York production editor, who organized the entire venture.

All along, through all the risks and uncertainties, through the travel and meetings, publisher Borden gave lavishly of his financial support, faith, and boyish adventurousness when he would arrive to sweep the authors away for sport or fun as necessary breaks from the slogging.

WRITING A BOOK ABOUT THE BOOK

Support for the Concept

My own decision to document the history of this book was triggered by a loss: its publisher, Gavin Borden, died suddenly in December 1991. In August 1992 a memorial for Borden took place at the Connecticut country home which he had shared with his spouse and business partner, Elizabeth, and their three children. Borden had been a man of spirit and style, whether in his remarkable publishing ventures, his mountain-climbing, or his playing a game of pool. In all this he had a capacity for diverse and deep friendships. This memorial provoked me to consider the unique group of family, neighbors, friends, and colleagues who had gathered from near and far. A number of those who came to pay tribute I had met before—particularly, the group of six primary authors of Molecular Biology of the Cell.

To some degree aware of the years of hard work and hard times that they had undergone together, I nevertheless found it remarkable that the six authors were so varied as a group. The Abbey Road photo of the authors on the back of the recently published third edition (Figure 1) was later to play this up: it showed that they were very human indeed, and not just the serious uniform academics as their names printed on the book’s spine would indicate. And it showed that they were more or less of the Beatles era, though not a group with the singular image of a rock band like the boys from Liverpool.

At the same time, the sudden loss of their friend and publisher at the age of 51 to a fast-moving cancer sharpened the sense that a story would be lost if not recorded. Thus when New York publisher Bob Worth suggested, during the evening’s conversation of the friends gathered there, that someone should “write a book about this book,” I offered myself as chronicler.
Just before I set out to pursue this, a letter arrived from Peter Buitenhuis, professor emeritus at Simon Fraser University, Vancouver, B.C., to whom I had written about both my project and concerns:

No doubt you are apprehensive in the face of all that scientific knowledge, but it seems to me that you will be concerned less with that than with the kind of human interaction that gives rise to such a successful enterprise. This is the fascination of your project. Individual success is understandable, if sometimes mysterious, but what makes a group work together so well—how much is it luck, serendipity, talent, warmth, understanding, tolerance, fact, determination, drive, obstinacy...?\textsuperscript{13}

![Figure 1](image_url)

The authors of *Molecular Biology of the Cell* could not resist this takeoff on the 1969 Beatles album cover. Much of the third edition was written in a house just around the corner from Abbey Road.

From left: James Watson, Keith Roberts, Martin Raff, Julian Lewis, Dennis Bray, and Bruce Alberts.

(Photograph by Richard Olivier, 1993.
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Further response about what was of interest to the project came from a chat with Ron Worton, chief of the Department of Genetics at the Hospital for Sick Children, Toronto, and head of the Human Genome Project in Canada.

It's the most valuable book in its area. We use it. But the difficulty of it all, the huge time element—I'm glad they did it, not me! Yes, I'd like to know the story of its beginnings, why it was those particular authors, what were their strategies, and how work on the book affected their families...\textsuperscript{14}
My goal, then, would be to search for the pieces of a puzzle—the puzzle which forms the story of how the book got written, and what made such a collaboration work. Yet I knew from the start that no clear and easy answers would ever be reached. As British publisher Vitek Tracz said to me on my arrival in London, “There is no formula. Take some brilliant people, a great publisher with patience and trust, lots of money, interesting ideas, close friendships developing, a market absolutely ready—and maybe the miracle will happen.”

Obstacles and Their Resolution

Interestingly, once I got to England to begin my rounds, the obstacle which I had thought I would have to overcome—of not being a scientist myself—turned out to be of little concern to the authors themselves. However, I was to discover another concern on the part of several. Initially, everyone had been enthusiastic about the chronicling of their story. But once I began my visits to each individually, I ran into hesitations about this “story of their book.” In London, Martin Raff expressed his concern that it would in some way be “publicity,” something none of them wanted. At Oxford, Julian Lewis told me of his reservations. He said that they had all “put science first” in this book and deliberately left out personalities and names altogether. Now, he felt leery of making private life public. Then also, there had been “conflicts and tensions,” particularly for the first edition, when there was so much uncertainty. “It’s not as if there are any deep dark secrets; it’s just... delicate things. But the book is still in process and relationships are fragile.” He added, “And I suppose [I have these reservations partly] because I’m a bit shy.” He thought a moment. “But talking about how a book comes to be done, who makes what decisions, that is interesting.” To this I responded that my intention was not to look for the “gossip and the juicy bits,” but to write about how very different people got together regularly and lived together for periods of time over years, tried to balance their families, professional lives, and this very demanding writing, and somehow, despite the pains and conflicts, perhaps even partly because of them, managed to have come up with something quite remarkable. I also mentioned that readers of Molecular Biology of the Cell, historians of the book, and sociologists, perhaps also rhetoricians of science, and those about to write a textbook themselves—all may find this story interesting and useful. Since then, I have found that as a story of several fascinating characters together pursuing a worthy enterprise, it is one of broad human interest.

Once such concerns were voiced and discussed, interviewing proceeded well, for the courage that allows scientists to publish a textbook carries them through on other fronts. As well, their friendship, forged
through 15 years and three editions, had made them a somewhat more relaxed group, as they appear in the London garden of the house where they worked on the third edition (Figure 2).

From the time that I decided to chronicle the story of this innovative team, I began practical preparations. I first obtained a six-month research leave, with the rationale that studying a model of excellence—in this case, of collaboration—can be useful either for innovation or affirmation of what is already being done in education, whether in the co-authoring of new and changing curricula or in classroom group endeavors. However, I needed more financial backing for travel and materials, and on this matter I ran into what was my first major obstacle. After applying to a number of potential sources in Canada, Great Britain, and the USA, I discovered that funding for such a project was difficult to find, owing to its novelty and its pioneering nature: it was neither a humanities nor a science project as traditionally understood. But with the granting of the research leave and my own intrinsic interest, I had long decided that I would go ahead despite any difficulty.

Figure 2
Left to right: Bruce Alberts, Keith Roberts, Martin Raff, James Watson, Dennis Bray, and Julian Lewis.
Another obstacle, in my mind, was the fact that while my education was long and deep in the humanities, my science background was limited. And so, as a rookie, a non-scientist, I read science. Starting with *Molecular Biology of the Cell* itself, I found it wisely paced and well presented, with exciting material, though some was beyond my ken. Then thoughtful, articulate essay collections like Max Perutz’s *Is Science Necessary?*¹⁸ and Lewis Thomas’s *The Lives of a Cell*¹⁹ gave me pause for reflection on the way they bridged the worlds of ordinary life and science. I also read many science biographies and stories, including James Watson’s lively *The Double Helix*. Finally, I read Horace Judson’s compelling, scholarly, and lucid *The Eighth Day of Creation*.²⁰

Other preparations included consultation with others; in particular, McGill professor emeritus in biochemistry, Theodore Sourkes, shared with me his personal ruminations on possible strategies for obtaining background information; on ways to approach and get the best from the authors; on documentation and the organization of data collected; on exploring various models of telling a story that involves both personalities and science; and on getting help for the scientific material. Others gave practical tips for use of computer and tape recorder. Still others volunteered to give feedback on the script.

All this activity helped in the preparation for my visits, with tape recorder, notebook computer, and a list of questions, along with an invitation from the six authors and Elizabeth Borden, now president of Garland, first to attend a book meeting in London that was a wrap-up to the third edition, and then to interview each of the authors and editor individually in his or her own home, laboratory, or office. Much shorter but useful conversations were to be held with members of the authors’ families and their publishing colleagues.

Shaping the Story

In the end, no preconceived plan or format to my own book was clearly the right one. I decided to let the materials in some way shape the form. Thus my book, whose working title is *A Window on Collaboration: The Story of Molecular Biology of the Cell*, offers the perspectives, 10 years after the struggle to bring out the first edition, of the six main authors and their editor. There is no single way of wholly describing the complex activities and relationship that went into the textbook. Rather, like a prism, one can look in from many sides.

Thus, my book will begin with an introduction on the changing world of science at the time of *Molecular Biology of the Cell*. Then a timeline of the first edition and a cameo of each of the six authors will provide a frame of reference. The main part of the book will be organized
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gaccording to the following chapters, whose titles vary with the authors' and editor's unique visions, presented in summary here.

a) James Watson: How Do You Start a Book?
On a late August summer afternoon at Cold Spring Harbor, Watson reminisced about his life with typical wit, casual style, intelligence, and "American" willingness "not to follow conventions when they block your path forward."21 Such bold qualities have carried him through many ventures, including the discovery that led to a youthful Nobel prize. About the conception and plan for Molecular Biology of the Cell, he delved into the history of what was happening in science then, in the publishing world, in the conversations he was having with colleagues, in his contact with a publisher willing to take it all on, and in his careful reflection about choosing authors who have certain qualities. Watson is a great creative thinker, and this book was his idea.

b) Bruce Alberts: The Mountain-Climbing Team
A friendly, bright man with generosity of spirit and ability to organize grass-roots ventures, Alberts talked of his own background, and of volunteer efforts like CityScience which he initiated in San Francisco for schoolchildren. About the book, he remembered the enormity of the task, and the pain, particularly before the first edition, when their pathway was not yet clear and young families were finding it hard. Without the sense of comradeship, like a "mountain-climbing team,"22 he wonders if they could have persevered. But with this bond, like climbers tied in to the same rope, it was impossible to quit. Everything improved remarkably after the book was first published and was so well received: yet the workloads and the deadlines still loom!

c) Martin Raff: Getting It Right for Students
An idealist and an intellectual, Raff talked of the key issues in the book process for him. It was crucial for him to discover from the start that he could work closely with Alberts, get insights together, and agree on everything. That was the foundation. As well, the various gifts of each of the other authors were needed for the total effort, and the reliable work of the publishing team around them. At the outset, Watson's "godfathering" it all enthusiastically, and Borden's full commitment throughout, carried them along. The fact that the working summers made it possible for his children to have a holiday with him was also vital. Then the pleasures of learning broadly in science, and of writing more clearly, were great rewards. And finally, what intrigued him from the outset and carried him along was the possibility of reaching and "getting it right" for wide numbers of students, and of making a textbook that was designed for them in the best way the authors knew.
What was the final decisive factor that allowed them to succeed? "Keeping the group together at last, through thick and thin, ongoing through the three editions." He described how this was possible: "The strength of the group was to adjust to all the foibles and make it work." At least for Raff personally, and perhaps for all of them, the drive to get it right for students fuelled their ongoing efforts.

d) Dennis Bray: Group Drama

Scientist and artist of wide-ranging interests and experience, Bray described, among other things, the difficulties he had with a few co-authors who, he felt, rode roughshod over his writing. In retrospect, he feels that some of his ideas have since been proven right. In any case, and particularly now that after a crisis he was approached to join them all again and to contribute, he can at last speculate why at one point the "group drama" became painful to him. First, he had not come through the traditional "Oxbridge" route in an academic English world where that made a difference, at least in his own inner confidence. And second, he now sees that his personal belief about writing which he carried with him into this coauthorship was that one wrote alone and the best that one could, and that it was then "set," and should not be tampered with. Of course this was bound to run into trouble in a true collaboration. Indeed, he went away at one point and wrote his very own book. This experience was satisfying and allowed him to return to the group with a willing heart.

e) Keith Roberts: Images

With characteristic joie de vivre, Roberts reflected on his own love of both art and science, and how he has pursued both in many settings, from Cambridge, England (science student and also production manager in student theatre and publication) to Cambridge, Massachusetts (assistant in Watson's lab and then illustrator of his Gene). He focused on the collaborative aspect as being the most positive and pleasurable part of the book enterprise, and on how such a way of doing things is increasingly necessary in all fields, particularly in that of the science textbook, which itself must evolve constantly to reflect new information. He also described the pleasure of making knowledge more accessible through pleasing, simple, visual "images," with a hand-drawn feel to the drawing even when now much is done on computer.

f) Julian Lewis: Language and Edifices

Lewis speculated thoughtfully on the experience of coauthoring Molecular Biology of the Cell. The enormous amount of work, the concern over time away from his young family, and his own burden of finding the writing process slow and painful—despite the fact that his colleagues
all agree that he is the best writer of them all and a joy to read—have not made the venture easy. Nevertheless, both the activity and the outcome have had great satisfactions as well. In response to the question whether the mixture of British, Canadian, and American scientists made the group a better one, his answer was provocative: that less the cultural differences, and more the juxtaposition of personalities, made for a rich interaction. He said that there were those who had a "fascination with intellectual edifices" and those with a "passionate curiosity to discover." His own love of and background in physics has put him with the former. He posed an interesting juxtaposition of his own about language, finally: "Ambiguity is admired in art and can be crucial to poetry. Clarity is admired in science. The goal of good science writing must be clarity because it is about an unfamiliar world. Yet the science writer must be creative in order to avoid heavy, boring writing."

The spirit of the book's publisher, Gavin Borden, will be woven through the tapestry. "Without Gavin, no book," was Raff's sentiment, which no one disputed. "He provided that element of spark. He was always willing to think about any possibility—writing on the top of Everest, if necessary." The conclusion to my book will survey the changing landscape of science, education, and publishing, as well as the enduring puzzles of personalities and collaborative work, which have the constant capacity to tear the tapestry apart or to render it rich and full.

NOTES


4 Gene Johnson of Indiana University has updated his HyperCell each year since 1992; it is ordered through Garland Publishing.


6 James D. Watson received his PhD from the University of Indiana and is currently Director of the Cold Spring Harbor Laboratory. He is the author of Molecular Biology of the Gene (New York: W. A. Benjamin, 1965, with subsequent editions in 1970, 1976, 1987, and 1993) and The Double Helix (New York: Atheneum Publishers, 1969). With Francis Crick and Maurice Wilkins he won the Nobel Prize in Medicine and Physiology in 1952 for their work on DNA, which resulted in Crick and Watson's discovery of its structure as that of a double helix.

7 From Garland's then vice president Ruth Adams' memo to Gail Rentsch on "MBoC History," 4 June 1993.

8 Martin Raff received his MD degree from McGill University and is currently a Professor in the MRC Laboratory for Molecular Cell Biology and the Biology Department, University College, London.
9 Keith Roberts received his PhD from Cambridge University and is currently Head of the Department of Cell Biology at the John Innes Institute, Norwich.
10 Bruce Alberts received his PhD from Harvard University, and is currently President of the National Academy of Sciences and Professor of biochemistry and biophysics at the University of California, San Francisco.
11 Julian Lewis received his DPhil from Oxford University and is currently a Senior Scientist in the Imperial Cancer Research Fund Developmental Biology Unit, Oxford University.
12 Dennis Bray received his PhD from the Massachusetts Institute of Technology and is currently a Medical Research Council Fellow in the Department of Zoology, Cambridge University.
13 Peter Buitenhuis to Heather Burton, 23 August 1993.
14 Phone conversation between Ron Worton and Heather Burton, Toronto, 10 December 1993.
15 Conversation between Vitek Tracz and Heather Burton at his Current Biology office in London, 9 September 1993.