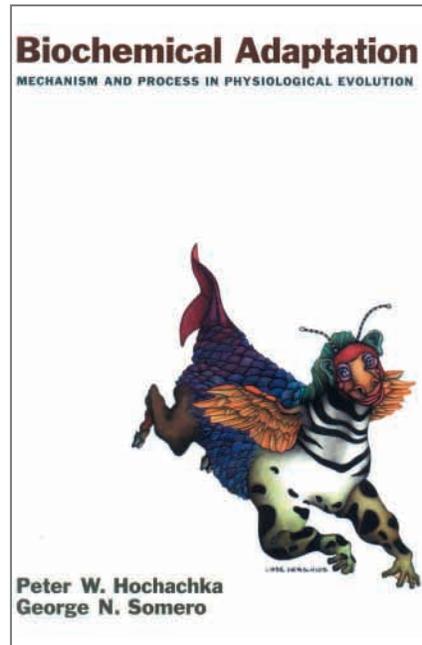


BLUEPRINT FOR AN ADVENTURE



Biochemical Adaptation – Mechanism and Process in Physiological Evolution

By Peter W. Hochachka and George N. Somero

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Peter Hochachka and George Somero have come together again to publish a *tour de force* that the comparative physiology/biochemistry community has been awaiting for years. Book I of *Biochemical Adaptation* appeared in 1974 and was a superb story. The field was young. The little data that existed were used to present ideas as to how organisms adapt to carbon dioxide, oxygen, water and solute, nitrogenous wastes, temperature, pressure and buoyancy. This book served as the bible for many comparative physiologists grasping for mechanisms to explain the diversity of adaptations, and a field was born. Finally, we understood the importance of biochemistry as it was put into a 'real' organism perspective rather than the simple mammal–bacteria systems we were all taught!

Book II was published ten years later and relied upon the data generated by the

followers (and there were many) of this comparative biochemistry approach. Moreover, it provided 'real' data for many of the proposed mechanisms presented in Book I. One was struck by how many explanations proposed in Book I by Peter and George were actually supported by the collected data. Like the original volume, Book II examined exercise, oxygen limitations, switching off metabolism, water–solute, temperature and deep sea adaptations. This volume pushed the boundaries of the comparative field while proposing yet more fascinating experiments.

And now Book III. Book III was a very long time in coming, especially for those of us wanting to hear more from these two visionaries. This book plunges head first into the sticky issue of physiological evolution, the subtitle of the text. The first chapter is one that every comparative biologist should read – it dissects the word 'adaptation' into its phylogenetic and functional derivations, ending with the concepts of unity and diversity of biochemistry. The idea that unity arises from a core set of genes, and diversity is the rest, is a novel way of explaining this key biological concept. This chapter is an excellent guide for both the novice and the practitioner, and one I will return to each time my own teaching touches on 'biochemical adaptations'. This third volume differs from either of the first two by incorporating a significant amount of molecular analysis into many of the chapters, while reducing the coverage to oxygen availability, water–solute and temperature, together with an introductory chapter on metabolism, regulation and homeostasis. It is these areas where the authors have spent much of their research energies over the past decades.

Biochemical Adaptation – Mechanism and Process in Physiological Evolution is a bit inconsistent in how it covers the material. The last two chapters (Chapter 6 – 'water–solute' and Chapter 7 – 'temperature') begin with the basics and take the reader through a series of logical descriptions, moving easily from the gene level to the whole organism. These chapters appear to be well designed for teaching and engaging the novice. Chapters 3–5 on oxygen availability are written more for the practitioner than the novice, as leaps of knowledge are often required for understanding and deriving the most from the presentation. Even so, the enthusiasm and vision of these authors should continue to captivate. In what other

book would you find an explanation of the intricacies of hypoxia-mediated regulation of glycolytic enzymes by hypoxia-inducible factor 1 (HIF 1) and the evolution of cellular osmolyte systems? What is fascinating about this book is the sheer variety of material covered and the obvious excitement the authors bring to these topics. They encourage the reader to think 'beyond the page', to explore explanations for the data that are presented.

The question needs to be asked 'who is this book aimed at?' As noted above, some sections can be read by those with minimal preparation in physiology and biochemistry, although a companion

biochemistry text should be close at hand to sort through some of the complexities. At the same time, those of us who had the good fortune to read and study the research done by Peter and George will learn a great deal from this text. Not just from the material itself, but how the story is told. Peter wrote in my copy of Book II: "To Tom Moon, who appreciates the many facets of scientific adventures – which make the endeavour so much fun". This book, and with it the field of 'biochemical adaptations', is an adventure and to live it is to learn from it. Like its predecessors, Book III will serve the field well – it provides a new blueprint to guide the next generation of researchers willing to grasp the adventure and learn how the huge

extent of biological diversity can be explained by relatively small genetic differences. *Biochemical Adaptation – Mechanism and Process in Physiological Evolution* is a testament to the love Peter Hochachka had for the science that he must be considered to have 'fathered' back in the 1960s.

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