Neither Physics nor Chemistry: A History of Quantum Chemistry

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University Press, 2007).

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method. It includes a good mix of fun-
ditional overview, with topics
such as the renormalization group
more general overview, with topics
be retrieved. Peliti’s book reminded me of such texts as
Kerson Huang’s Statistical Mechanics (2nd edition, Wiley, 1987); David Chander-
Modern Statistical Mechanics (Oxford University Press, 1987); and Mehran Kardar’s Statistical
Fields (both published by Cambridge University Press, 2007).

Of the books under review, Statistical Mechanics in a Nutshell provides the
more general overview, with topics such as the renormalization group
method. It includes a good mix of fund-
damental thermodynamics, phase behavior, and other key subjects. Even
so, I do not see it as a standalone book for introductory students, even if they
are energetic and serious; they will
need an expert teacher or practitioner to make the ideas become more vivid in
the classroom.

Kimani A. Stancil
Howard University
Washington, DC

Introduction to Experimental Biophysics

Biological Methods for Physical Scientists

Jay Nadeau
$89.95 (641 pp.).
ISBN 978-1-4398-2953-0

Each year a number of physicists leave various disciplines to become biophysicists. Those converted physicists are challenged to learn various life-science
laboratory techniques applicable to molecular biology, microbiology, biochemistry, and cell
biology, among other subfields. They also
must become familiar with the spectroscopic,
microscopic, and other important physical techniques that are now
available in many biological physics labs.

Those challenges highlight the need for efective laboratory manuals, proto-
cols, guides, and other instructional material. Jay Nadeau’s Introduction to
Experimental Biophysics: Biological Methods for Physical Scientists is an ambitious
text aimed at educating new graduate students about the important and most
common techniques used in a modern biological physics laboratory; it could
also serve nicely as a reference manual for advanced graduate students of new
or underused protocols. Whereas most
existing texts of its kind are aimed at
educating biologists or biochemists, Nadeau’s is aimed at young biophysicists and more seasoned researchers
transferring to the field.

Introduction to Experimental Biophysics includes chapters that cover basic con-
cepts behind commonly used biological techniques—for example, transfection,
protein purification, and protein crystallization. Other, more physically fla-
ored chapters discuss the concepts behind microscopy, surface chemistry,
inorganic nanoparticles, and quantum dots. Each chapter contains protocols
and the conceptual reasoning behind them, which is often useful to physicists
performing biological experiments for the
first time. Specific gems of the book include an overview in chapter 1 of the
physical principles common in biological systems; a detailed experimental
overview in chapter 5 of x-ray protein
crystallization and a useful trouble-
shooting section to help novices; and a
number of extremely useful discussions in chapter 10 on surface
modification and functionalization. Surface preparation
is particularly important in biophysiology: If done incorrectly, it can ruin
an otherwise beautiful experiment. The
end of each chapter includes extensive references, information about equip-
ment suppliers, helpful websites and software, and additional experimental
protocols.

Despite its more than 600 pages, the book is still lacking in some aspects.
Perhaps that’s not surprising, given its broad scope and ambitious nature.
First, most chapters give few details about advanced techniques. For
instance, in chapter 6, which covers light microscopy, only one paragraph
discusses total internal reflection fluorescence microscopy. Nowhere does the
book mention optical or magnetic
tweezers, which are used in force spectroscopy and are prevalent in modern
biological physics laboratories. Further,
various microscopies are discussed in multiple chapters, with electron micro-
copy (only scanning EM and not trans-
mmission EM) addressed in chapter 8 and
atomic force microscopy presented in
chapter 10.

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Overall, the many outstanding qual-
ties of Introduction to Experimental Biophysics should make it an essential part
of the biophysicist’s collection. For new
students, it is best partnered with the
following texts. At the Bench: A Labora-
atory Navigator (Cold Spring Harbor Lab-
atory Press, 2005), by Kathy Barker,
contains useful information about the
social forces that shape the establish-
ment of laboratories and how to cope
with working in the lab on a daily basis.

And Principles and Techniques of Biochem-
istry and Molecular Biology (7th edition,
Cambridge University Press, 2010),
edited by Keith Wilson and John
Walker, provides useful basic informa-
tion, including a table of units and stan-
dard formulas needed to analyze bio-
chemical data.

Introduction to Experimental Biophys-
ics assumes readers are already
acclimated to the lab and can figure out
for themselves how to analyze the data,
if only they could get the data using the
right biological experimental tech-
niques. This book is likely to become
increasingly useful with future editions
and iterations, but in its current state,
other sources—most likely collaborat-
biologists—will be required to fill in
the gaps.

Jennifer L. Ross
University of Massachusetts Amherst

Neither Physics nor Chemistry

A History of Quantum Chemistry

Kostas Gavroglu and Ana Simões
$40.00 (351 pp.).

The way new areas of science are
birtned is similar to the way continental
masses are formed: by the contact and
interaction of previously existing structures, which are subsequently modified so that they never are what they were before. And just as interactions between continental masses lead to tectonic events such as earthquakes and volcanic activity, the gestation of a new scientific field is usually not smooth.

Quantum chemistry was born in a rocky, volcanic fashion, and the history of its formation has not been covered extensively until now. In Neither Physics nor Chemistry: A History of Quantum Chemistry, historians of science Kostas Gavroglu and Ana Simões trace the development of a field that came about through interactions among physics, chemistry, applied mathematics, and what we now call computer science. An illuminating and well-researched book, Neither Physics nor Chemistry covers the half-century expansion period of the 1920s to the 1970s, from the era of Walter Heitler and Fritz London through the tensions between the chemists and physicists, between the New World and the Old, and even among the actors in the field with differing political affilia-

tions. The book is full of interesting anecdotes, quotes, and foundational ideas conceived by those players.

Neither Physics nor Chemistry parallels Image and Logic: A Material Culture of Microphysics (University of Chicago Press, 1997; reviewed by W. K. H. Panofsky in Physics Today, December 1997, page 65). In Image and Logic, author Peter Galison paints a similar multidisciplinary picture of the birth of particle physics. In particular, in a chapter on computer simulation, Galison describes the conceptual “trading zone” between the physicists and computer engineers that, starting in the 1940s, led to the use of the first computers, such as the MANIAC at Los Alamos, to carry out Monte Carlo simulations. The book narrates the visionary work, from around the same time, of chemist Samuel Boys, who used the EDSAC computer in the UK to carry out early quantum chemistry calculations.

The biographies of the heroes of quantum chemistry are less known than those of the founders of quantum mechanics or of the creators of the atomic bomb. Many people know about Wolfgang Pauli or Werner Heisenberg, but fewer know about Hans Hellman or Robert Mulliken. Neither Physics nor Chemistry addresses that discrepancy. Moreover, it contains plenty of material about the critical discussions that are still relevant to how chemists work. If one wants to dig to the roots of why organic chemists still think in a “local” valence bonding picture, yet many theoretical chemists are rooted in molecular orbital theory, this book provides the historical context.

Almost a hundred years have passed since the beginnings of quantum chemistry, and both of the parent fields, quantum physics and chemistry, have changed a lot. One thrust of current quantum mechanics is quantum technology: Every day we witness advances in the development of novel devices that could be used for quantum information processing. Meanwhile, theorists are developing new ideas based on quantum information, and experimental physical chemists are using light to probe atoms and molecules at very short times and very high energies. The interaction between 21st-century physics and chemistry might lead either to a renewal of quantum chemistry or to a new field that harvests the current developments from physics and chemistry. Perhaps one might call it quantum information chemistry; that