Morange, Michel. 2000. *A History of Molecular Biology* (Cambridge, MA: Harvard University Press).

Müller-Wille, Staffan, and Hans-Jörg Rheinberger. 2009. *Vererbung: Geschichte und Kultur eines biologischen Konzepts* (Frankfurt/M: Fischer).

Olby, Robert Cecil. 1974. *The Path to the Double Helix: The Discovery of DNA* (London: Macmillan).

Rheinberger, Hans-Jörg. 1997. *Toward a History of Epistemic Things: Synthesizing Proteins in the Test Tube* (Stanford, CA: Stanford University Press).

Stubbe, Hans. 1972. *History of Genetics: From Prehistoric Times to the Rediscovery of Mendel's Laws* (Cambridge, MA: MIT Press).

Sturtevant, Alfred Henry. 2001. *A History of Genetics* (Cold Spring Harbour, NY: CSHL Press).

Waters, C. Kenneth. 2004. "What was classical genetics?" *Studies in History and Philosophy of Science* 35, 783–809.

Robert Meunier
Max Planck Institute for the History of Science
Boltzmannstraße 22
14195 Berlin
rmeunier@mpiwg-berlin.mpg.de

Theodore Sider, *Logic for Philosophy*, Oxford: Oxford University Press, 2010, 304 pp.

Sider's book is a welcomed addition to the series of logic textbooks published by Oxford University Press, taking its place as a good introduction aiming to provide a great supportive textbook for students of philosophy from the beginning of their education to the very end, and serving as a valuable handbook afterwards helping them in their research in areas of philosophy which employ a considerable amount of formal logic, including, but not limited to, metaphysics, epistemology, philosophy of language and philosophy of science.

It is interesting to notice that the book was dedicated to perhaps one of the most influential contemporary philosophers, Ed Gettier, and, while this is not worthwhile information per se, it sets the tone for the entire

book, setting its scope to provide a clear and precise logic textbook for students not specializing in logic. This is perhaps the book's greatest asset: it is abundant with examples of applications of logic to many relevant problems in philosophy. This especially holds true of the later chapters, where the applications come into greater focus.

The first chapter "What is logic?" gives a brief survey of the various aspects of logic. In most textbooks, this part usually contains a historical background, or an introduction to critical thinking, or translations. Here, this introductory chapter is used to give a very brief sketch of what logic consists of, and to delineate some key notions and concepts. In this reviewer's opinion, the distinction between logic and "metalogic" is pointless (consider the absurdity of e.g. "metastatistics"), but this distinction has become commonplace in philosophical logic, and as such it has to be explained outright as Sider does. The first chapter also has a review of (very basic) set theory, encompassing basic set operations and concepts. The section title "set theory" is a bit ambitious, but the treatment of the basic set concepts is clear and complete.

The second chapter "Propositional logic" gives a very detailed and perhaps somewhat advanced treatment of (classical) propositional logic. It has a superb exposition of sequents and Hilbert-style proofs, and only mentions natural deduction, which is quite interesting, but an inclusion of a brief sketch of natural deduction proofs would greatly increase the completeness of this chapter, with only a couple of pages more, since the inner workings of proof systems in general are explained in detail in the section on sequents. Also, the completeness proof is given in detail, with a very good explanation of what is going on on each stage of the proof. A great detail in this chapter is an excellent explanation of proofs by induction, with quite a few diagrams illustrating the procedures. In a sense, one could say that the inclusion of the soundness and completeness theorems serves to illustrate the use of induction, as opposed to the conventional approach where induction is used to prove completeness and soundness. Also, the approach for proving Lindenbaum's lemma uses denumerable languages and not Zorn's lemma, which is the conventional approach for textbooks.

The third chapter deals in nonclassical (non-modal) propositional systems. This is a hallmark of philosophical logic and puts this textbook in the textbook tradition set forth by Van Dalen and Priest. The chapter first considers alternative connectives, then alternative notations as exemplified by the Polish notation, and finally three-valued logics. The systems explored are Kleene's, Lukasiewicz's and Priest's, ending with a treatment of the proof-theoretical treatment of intuitionistic logic (the model-theoretic part will be presented significantly later).

The next chapter has a rather quick but detailed exposition of (classical) first order logic. This concise treatment is exceptionally clear and

somehow dispels the idea that first order logic needs to be harder for students to understand than propositional logic, and even though I had my doubts about first order logic explained in 17 pages, Sider does a great job. There is no proof of completeness or undecidability for first order logic, just a section that mentions the topics. At first it seems unfair, but considering the relevance of those proofs to non-logician-philosophers, Sider has made a good call, cutting a semester's worth of proofs which will be of no use to most philosophers. Logic is a science which is highly evolved, and even at the most basic level one has to make sacrifices in terms of width to give the reader, presumably students, the necessary time to take in the ideas and methods, so Sider's choice is at first quite surprising due to its unconventionality, but, from a philosopher's perspective, highly justified.

The next chapter expands classical first order logic, adding the identity symbol, function symbols, definite descriptions, generalized quantifiers, second-order logic and free logic. All of these topics are treated on a basic level, defining neither semantics nor proof systems. Here one would like to find the treatment of first order arithmetic, but unfortunately this was not included in this book. Considering that the study of arithmetic is a very large area of logic, very often not interesting to non-logicians, one can see the rationality behind such a choice for this particular book.

The next chapter is on (classical) modal propositional logic. Kripke frames and semantics, systems K, D, T, S4, S5 are explained, which covers the essential systems. Soundness and completeness are proved in a very straightforward style, reminiscent of the earlier treatment for the basic propositional logic. It is a bit regretful that no treatment of bisimulations is given and there is no mention of the finite model property or the invariance results. These omissions are somewhat surprising, since the topics are of great interest to non-logicians and provide more advanced tools for the application of logic to other areas of philosophy, in particular metaphysics (via modal logic) and epistemology (via epistemic logic).

The book continues with a chapter entitled "Beyond standard modal propositional logic". Deontic logic, epistemic logic and tense logic are all covered, providing a basic but complete insight into these areas of non-classical logic. Several philosophical aspects are briefly considered, especially under the subsection "the metaphysics of time". In this chapter the semantics of the intuitionistic calculus is also covered. These topics are not covered in much detail, but they provide a valuable insight to non-specialists, and as such fit quite well in the scope of this book.

The next chapter is quite unusual in that it covers a wholly philosophical topic, counterfactuals. The exposition starts with counterfactuals in the natural language. The properties of the natural language counterfactuals are explored, delineating the difference between counterfactuals and ma-

terial implication on one hand, and the difference between counterfactuals and strict implication on the other. The theories of Stalnaker and Lewis are presented as representable to the discussion, and are formalized enough to give a serious philosophical treatment.

A chapter on quantified modal logic follows, which includes a good portion of the philosophical problems connected with quantified modal logic, as well as interesting philosophical applications. The chapter ends with the proof calculi, and no completeness or soundness theorem is proved.

The last chapter, traditionally reserved for an introduction to the author's area of research (in Sider's case modality and persistence), is dedicated to two-dimensional modal logic. This non-classical logic uses the unary operator @ with the meaning "actually". The author explains its use in the modal context with an example. Consider two sentences: (1) Necessarily, if grass is blue, then grass is blue, and (2) Necessarily, if grass is blue, then actually grass is blue. As the author explains, the first sentence denotes a tautology, while the second is simply false. Just because the grass is blue in some world, does not entail that the grass is (necessarily) blue in the actual world. The operator @ acts in a way as a "modal homing beacon" so to say. The chapter later explores the application of the @-logic to some arguments from Kripke's *Naming and Necessity*, giving a rigorous scientific treatment of informal arguments.

The book is also complete with exercises at the end of each section and subsection. The number of exercises is relatively small compared to most textbooks, but in this reviewer's opinion is adequate and not burdensome. The appendix with the answers is somewhat incomplete, since some of the solutions are given only as hints, while others are completely omitted. The overall number of omitted solutions is about 20%, so the majority of the exercises still have solutions written out in the appendix.

From several other titles, the diligent student may have learned to avoid logic textbooks which have "philosophy/philosophical/for philosophers" in their titles, since it almost always suggests that the book is too technical to be an informal treatment, and too imprecise or incomplete to be labeled simply as "logic", "formal logic" or "mathematical logic". Sider's book is a more than welcome exception to this trend, and he delivers as he promises: all the logic needed for a working philosopher in one book. Epistemologists, philosophers of science, metaphysicists, linguists, will all find this book to be a valuable handbook. Logicians (having either a mathematical background or a philosophical background) might find themselves a little disappointed, but they are not the intended audience for this book.

Sandro Skansi
skansi.sandro@gmail.com