of lobbying in the US); the impact of new biotechnological developments, such as genetic engineering in the 1970s, that shifted the relevance of diseases from their aetiology to their genetics; and, finally, issues of reproductive decision-making and consent for the future use of archived blood samples.

The PKU Paradox challenges a key claim of the standard account, that the condition was well managed by a screening which was swiftly routinized as a result of the appliance of a straightforward test (the Guthrie test) and an even more straightforward dietary plan based on the absence of phenylalanine in foodstuffs. Paul and Brosco show that, in spite of the lack of a full understanding of the biochemistry of the disease and the uncertainties about the timing of using a restrictive diet – two issues that were contested by many scientists and physicians from the 1960s onwards – the PKU case was by then conceptualized as successful.

The PKU Paradox rests on twenty years of research into the history of the disease by Paul. Many of the main themes discussed in it are found in work she has previously published. However, this book is far from being just a rehearsal of the conclusions reached in all of her previous works – not only because it includes Brosco's contribution on issues of mental disability, but also because it contains in-depth discussion of new issues, such as what it means to live with PKU in general and with a PKU restrictive diet in particular, the distressing consequences of maternal PKU (a condition created by the success of the screening programs), and the issue of the history of the regulation of reproductive choices in the post-war United States.

The PKU Paradox is a significant book for readers interested in understanding the many factors and intricacies involved in the history of diseases, in particular genetic diseases. It is also a precious exemplar for history-of-medicine students and others looking to develop the skill of writing clearly and succinctly whilst making timely use of extensive and well-placed references in support of sound argumentation. *The PKU Paradox* is an illuminating book, for it provides a compelling argument against the simplistic and persistent view that genetic diseases are fixed in the lab. Instead, it proposes a complex contextual history, not only a more persuasive one, but also one that provides a model for comprehensive study of other diseases, genetic or not.

Norberto Serpente
University College London

Carsten Timmermann, **A History of Lung Cancer: The Recalcitrant Disease**. Basingstoke: Palgrave Macmillan, 2014. Pp. 256. ISBN 978-1-4039-8802-7. £53.00 (hardback).
doi:10.1017/S0007087415000515

Carsten Timmermann's monograph on the history of lung cancer follows several years' work concerning cancer and cancer patients. *A History of Lung Cancer* primarily covers the early development of treatment for lung cancer in the UK and, to an extent, the USA.

Timmermann begins his introduction with a case study from the 1840s, detailing the illness of a Mrs Benbow, who received treatment at Guy's Hospital, London. After her death, it was learned that Mrs Benbow had had lung cancer. A swift comparison of the experiences of mid-nineteenth-century lung cancer patients with those of the mid-twentieth century suggests that little had changed with regard to treatment or survival. Setting the scene for the book, Timmermann questions why this may be, particularly in light of so many other medical improvements in the twentieth century. What makes lung cancer so different? Why is it 'recalcitrant'?

In order to help answer this question, Timmermann considers clinical research and treatment options, and the role of smoking in lung cancer history. Most chapters are framed with this first consideration in mind. The second chapter considers the first diagnoses of lung cancer during a period of improving pathology. The transition from tissue morphology to cell pathology is briefly considered in the context of lung cancer, suggesting that both old and new concepts were combined in developing nineteenth-century lung cancer diagnoses. The rise of epidemiology

in the late nineteenth century initially indicated that there was an increasing incidence of cancers in the latter decades of the century, but many suggested that this was an increase in diagnosis as opposed to incidence.

Timmermann outlines the first primary treatment for lung cancer in his third chapter: surgery. In the first half of the twentieth century, surgery was the preferred option for physicians, sending their lung cancer patients to the surgeon. Not all patients were suitable for surgery, however; survival rates were poor; and, by the 1940s, the incidence of lung cancer was rising dramatically.

In an effort to maintain the chronological organization of the book, Timmermann's fifth chapter concerns lung cancer treatment from the 1950s to the 1970s. Despite better organization, research and data collection, the conclusion is that there were more people being diagnosed with lung cancer, with little improvement in treatment or survival rates. This dire state of affairs resulted in a push for more work on preventing, screening and treating lung cancer from the 1960s onwards: the topic of a sixth chapter. Again, the lack of successful outcomes is noted, despite more being learned about the disease. For instance, different types of lung cancer were now identifiable, and prognosis following surgical treatment was improving. However, radiotherapy was still considered to be a poor second option to surgery, and chemotherapy was thought to be of little use. So poor was the prognosis that many died without being told they had lung cancer (although no ethical considerations of this are mentioned).

Cancer working groups were set up to help improve prognosis, and, as generations of new practitioners were recruited to the group, newer therapy regimes were considered. As wider dissemination of ideas and results occurred through the Lung Cancer Working Group, and standardization of protocols and cancer staging were achieved, more was learned about lung cancer and about better courses of treatment for individual patients. This said, Timmermann suggests that lung cancer was still a neglected field; although he does not explicitly state it here, there are clear links to the fourth and seventh chapters: stigmatization.

The fourth chapter describes a link that has been synonymous with lung cancer in the latter half of the twentieth century: smoking. Convincingly, Timmermann shows that the link between smoking and lung cancer made this condition different to many other malignant diseases, succeeding in giving an informative history of the causal link between smoking and lung cancer in a concise manner.

In a useful seventh chapter, Timmerman carefully teases out how and why lung cancer in particular became so stigmatized, occasionally comparing the condition with tuberculosis and HIV (there is no mention, however, about how poor lifestyle choices have become stigmatized following research linking them with cancer in general). Guilt and stigmatization are shown to affect treatment requested and given for lung cancer, and lack of funding for this 'self-inflicted' disease continued. This said, smokers present themselves as knowing the health risks of smoking (and over-estimating their risk of lung cancer); however, Timmermann mentions no studies carried out asking why smokers continue. This would have made a relevant addition considering the emphasis on prevention of lung cancer in the latter half of the book.

There appears to be some confusion in the first few chapters about the audience for the book – for example, some technical terms are explained (more than once), whilst others are not. There is also an impression given that each chapter was written with a certain amount of segregation in mind, as though each was considered apart from the rest. This has resulted in some needless repetition, and occasionally missed links to other sections of the book that are relevant; this is particularly evident in the later chapters, where the story becomes more complex. This said, the predominant aims of the book are clear, and the chronology connects the chapters well.

Timmermann's account is somewhat shrouded in pessimism, with lung cancer shaded as an 'avoidable' cancer – a condition related to poor lifestyle choices, and even deviancy; the mood is not lifted with any account of more recent advances in lung cancer treatments, which have decreased mortality rates little in the past decade or so. This follows Timmermann's theme of

recalcitrance throughout; lung cancer has such a label not only due to its biology, or the difficulty of its treatment, but because of its association with being self-inflicted by a stigmatized, marginalized section of society. Timmermann shows, however, that despite the recalcitrant nature of lung cancer, this has not translated into lack of interest; in fact, obstinate researchers, clinicians and patients respond to this recalcitrance the only way they can: by keeping on trying.

Cheryl Lancaster
Durham University

Joseph November, **Biomedical Computing: Digitizing Life in the United States**. Baltimore: Johns Hopkins University Press, 2012. Pp. xvi + 344. ISBN 978-1-4214-0468-4. £31.00 (hardback).
doi:10.1017/S0007087415000527

Today it is virtually impossible to find a biological laboratory without computers; they are essential tools for the study of life. But fifty years ago, most biologists believed that computers were incompatible with biological research. For computers to enter the lab, biology had to be rendered fit for computation, and computers had to be adapted to research. Joseph November's *Biomedical Computing* narrates the early history of these intertwined processes, revealing a diversity of post-war disciplinary, infrastructural and national political agendas that shaped both computing and biology. Focusing on the 1950s and 1960s, his analysis deals with big institutions – such as the National Institutes of Health (NIH) and Stanford University – from which a small cast of individuals emerges as particularly important. November does a fine job in highlighting resistance to (and the failures of) their agendas, setting all of this against a background of post-war American optimism and the Cold War. In so doing, rich local detail emerges, particularly the diverse professionals involved and the places they worked: computer visionaries, physicians, biologists, technicians, federal administrators and computer manufacturers in laboratories, hospitals and clerical offices.

November's account begins with Second World War operations research (OR) – a constellation of quantitative, statistical and managerial methods first developed to optimize British radar systems, and later incorporated into post-war science on both sides of the Atlantic. Partly through the guidance of two innovators steeped in OR – Robert S. Ledley and Lee B. Lusted – and stimulated by the 1959 launch of sputnik, the NIH began actively promoting computer development and use. From 1960, with direct support from the US Congress and with guidance from Ledley's non-profit organization dedicated to promoting the use of computers in biomedicine (the National Biomedical Research Foundation), the NIH sought nothing less than to transform the life sciences.

Initially the NIH concentrated on the multi-million-dollar funding and development of large-scale computer centres – an infrastructural model drawn from physics. But the anticipated multitudes demanding to use these facilities never appeared; more work was needed both to convince biologists of their utility and to make biological data more amenable to computation. So the NIH changed tack, directing investment to the development of much smaller, cheaper, programmable computers in the hope that this would nudge biologists in more quantitative directions. Charting this shift, November focuses on the successful career of the NIH-sponsored Laboratory Instrument Computer (LINC) – designed by Wesley Clark of the military-funded MIT Lincoln Lab – which had a graphical interface and was responsive and adaptable, and allowed real-time intervention and calibration, qualities that its developers and promoters believed were essential for computers to be of use in biology.

For historians of post-war biology, *Biomedical Computing* is richest in its discussion of the LINC programme and its potential to promote and disrupt research agendas. In stark contrast to large mainframe computers, the LINC was intended to be 'just another laboratory instrument' (p. 178): it was small ('refrigerator sized') and flexible, integrating seamlessly into existing research programmes without new staff or infrastructure. But despite researchers' reported delight in the