József Illy, *The Practical Einstein: Experiments, Patents, Inventions*. Baltimore: Johns Hopkins University Press, 2012. Pp. xi+202. ISBN 978-1-4214-0457-8. £31.00 (hardback).

Sean Johnston

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experience for the reader (this reviewer found that revisiting earlier passages was a frequent necessity), the sheer volume of material present reinforces the meticulous and thorough nature of the research. *Bacteriology in British India* is not simply a repetition or reinforcement of staid notions of imperial tensions and the role of medical science as a tool of empire. Rather we learn that colonial scientists adapted their understandings of bacteriology to fit new environmental contexts, and that this led to the extensive deployment of French and German bacteriological strategies which were never quite as thoroughly adopted in Britain. There are clear parallels and intriguing contrasts with the case of bacteriology in Australia, where (largely French) medical scientists such as Adrien Loir (Pasteur's nephew) treated both the country and its wildlife as a new and exciting playground in which to further explore the possibilities afforded by laboratory and field experimentation. Just as Bombay became an 'experimental theater of plague vaccines' (p. 54), Loir and his colleagues gave dramatic public displays of European vaccination proficiency and superiority.

It is perhaps unsurprising given the obvious stated scope of Chakrabarti's work that we learn little of the similarities and differences between colonial India and other parts of the British Empire, yet this points to limitations elsewhere within the field, where the potential for internationally comparative studies has yet to be fully realized. In this sense, *Bacteriology in British India* invites exactly such synthetic studies; we might learn much from combining the insights from this excellent book with other case studies of colonial and imperial bacteriological assimilation, transition and transformation from around the world.

James F. Stark
University of Leeds

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Albert Einstein's practical side has usually been overshadowed by his other contributions to science. Some of his inventions and technological ideas have received scholarly attention, but usually by specialists in those technologies, such as refrigeration and aeronautics. This book, though, helps to redress the balance for a wide range of readers.

József Illy has not only explored Einstein's published *Collected Papers*, which cover his work up to 1922, but also combed through subsequent correspondence, publications and ephemera at the Einstein archive in Jerusalem. The result is a light-touch treatment that surveys his musings, his experiments, his expert judgements and his inventions.

The diverse examples of Einstein's interests suggest qualities that are not typically part of his mythos. First, Einstein was not a chance technologist owing to the accident of a father and uncle in the electrical-engineering business, or a lucky break in gaining a secure job as a patent clerk. As the author observes, Einstein had a lifelong interest in 'direct contact with experience' (p. 2), although he never considered a career in technology. By 1904 – a year after his *Wunderjahr* with papers on special relativity, the photoelectric effect and Brownian motion – he was deemed by his employers capable of handling the most difficult technical patent applications. And, periodically over the rest of his life, he recalled that period as his favourite, enjoying competence at his job yet free to think about scientific questions that interested him without the pressure to 'lay golden eggs' (p. 5) that later weighed on him. Einstein remained at the patent office until 1909 and, more tellingly, served periodically as an expert assessor and consultant on patents and designs over the rest of his life.

Illy tracks part of Einstein's popular acclaim to his ability to offer quotable assessments of new inventions for news stories, owing to his familiarity with current research and patent applications. But not all of his technological musings and experimental ideas (which he dubbed 'escapades'

and 'detours' (p. 5)) made an impact or set precedents. Some, like a 1926 explanation for the meandering of rivers, were soon forgotten or scarcely cited. Others, such as a 1912 proposal for an ether-detection test founded on a torsion pendulum experiment, had been tried with a null result over two decades earlier.

As such dates suggest, Einstein intermingled this work with his better-known activities. Between 1914 and 1922, encompassing the period during which he completed work on general relativity and then achieved celebrity following the eclipse observations of Arthur Eddington, Einstein served as an expert critic on a long-running patent dispute concerning gyrocompasses. From 1921 he was a well-paid consultant for a German manufacturer of electric hammers. The stream of technical opinions and patent judgements continued through the 1930s, and intermingled with carefully considered inventions that he frequently pursued with contemporaries including Leó Szilárd, Rudolph Goldschmidt and Gustav Bucky. The range of inventions – from air foils to hearing aids to waterproof clothing – is as varied as that of the most prolific inventors. It would have been equally interesting to know what fraction of these received patents and were introduced commercially with market success. The results, akin to the 'key performance indicators' that burden academics today, might provide a sense of Einstein's creative success as productive inventor. It would have been interesting to have further analysis, too, of how important and regular these practical activities were to his varied life.

There are a very few unclear translations, such as 'nitrogen acid' (p. 37), and a description of an electric piano strummed at 'the eigenfrequency of the wire or its multiples' (p. 58), for which a more familiar description might be its 'resonant frequency and harmonics'. This short but well-documented book is not a radical evaluation, but an engaging one. It suggests a more human and more 'hands-on' Einstein than the popular myth, and perhaps a better role model: his career of mixed productivity, eclectic interests, consulting work and brief enthusiasms may be recognizable to more than a few contemporary scientists.

Sean Johnston
University of Glasgow

Peter Ayres, **Shaping Ecology: The Life of Arthur Tansley**. Chichester: Wiley-Blackwell, 2012. Pp. xii + 213. ISBN 978-0-470-67154-2. £19.99 (paperback).
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This volume functions well as an introduction to the life of Arthur Tansley (1871–1955) and to the emergence of ecology as a science, a career and an institution. Tansley was a key figure in the development of ecology in Britain over many decades. Ayres skilfully weaves the various strategies Tansley used to influence its development into his biographical narrative. In no particular order of importance, these strategies were, first, from early in his career, Tansley's championing of ecology's development conceptually, insisting in particular on it being defined as a study of *dynamic* systems (with the concomitant necessity of field studies), and, later, in the 1930s, his arguing against idealistic holistic conceptions of ecosystems with his own materialistic version. Second, there was his founding and editorial control of two key journals in the subject for several decades (*New Phytologist* from 1902 and *Journal of Ecology* from 1913), through which he encouraged others to use his methodology (although he did not unduly censure others for disagreeing with him; he had a reputation for fairness). Third, especially as head of the Department of Botany at Oxford (1927–1937), he was able to promote his concepts and methodology of ecology to students (i.e. a younger generation that he encouraged to work in ecology). Fourth, after a few years struggling to obtain money for this department, he finally acquired extra space and funding to increase the research space available. Fifth, whilst he did not have a prolific output in research papers, those he did publish were often deliberately (and successfully) intended as exemplars for his methodology (as were his books). Sixth, later in his life, and at a time when