particles, stems from beautiful thoughts framed by appeals to symmetry. The Eightfold Way, named by physicist Murray Gell-Mann after the Noble Eightfold Path of Buddhism, organizes elementary particles into octets; the Higgs, discovered in 2012, is the final missing link in the standard model.

Now the search is on for a unifying principle to take us back to simplicity. Supersymmetry, the most beautiful idea of all, unites two fundamental types of particles, fermions and bosons, distinguished by their spins. It postulates massive 'superpartners' for each particle, the lightest of which is a stable candidate for dark matter. Some see a lack of elegance in a theory that has some 120 adjustable degrees of freedom. The situation is, however, being redeemed in part through the enormous efforts of experimental particle physicists to measure many of these numbers. Only one real issue remains: at what energies must one smash particles together to seek supersymmetry's elusive signature? Wilczek optimistically predicts that we will discover this holy grail of physics in five years.

Occasionally the search for beauty has led us astray. Science was set back for centuries by the epicycles with which Greek astronomer Ptolemy described planetary motions. Modern data debunked Fred Hoyle's steady-state theory of the Universe. And even particle physics, with its grand hopes of unification, offers no insight into serious cosmological problems such as why dark matter is more than five times as abundant as ordinary matter. Most recently there has been string theory, the compellingly beautiful union of mathematical simplicity with quantum theory, particle physics and gravity. Its advocates have provoked a controversy: can a theory be so beautiful that we award it scientific accolades for its synthetic capacity without an empirical test, or must we dump it on the scrap heap of history for its lack of grounding truth?

Persistent voices insist that a theory of physics must lead to experimental verification. Wilczek is emphatic about this, as was Isaac Newton, who would like us to see empiricism as the search for truth. If truth and beauty are inseparable, that circle is closed. That is where supersymmetry will rise or fall. I hope for the latter, although I am reconciled to waiting for a new generation of unprecedentedly powerful particle colliders to reach the frontiers of our unifying theory. ■

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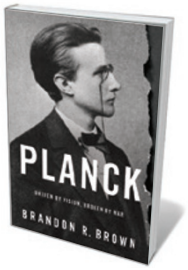
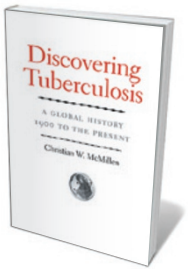
Books in brief

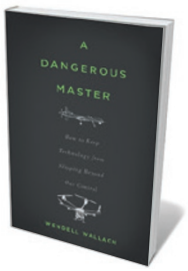


Planck: Driven by Vision, Broken by War
Brandon R. Brown OXFORD UNIVERSITY PRESS *(2015)*
The life of Max Planck, 'father of quantum theory', smacks of enigma: his personal papers were mostly destroyed in the Second World War. Physicist Brandon Brown has mined what survived for this illuminating biography. The main thread is the endgame of the Second World War, when the elderly Planck endured tribulations such as his son Erwin's trial and execution for treason against the Reich. Through this Brown interweaves a gripping backstory, ranging from Planck's landmark theoretical description of black-body radiation to his loyal advocacy for fellow physicist Lise Meitner.

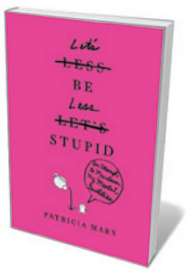


Discovering Tuberculosis: A Global History, 1900 to the Present
Christian W. McMillen YALE UNIVERSITY PRESS *(2015)*
Polio incidence is down by 99% since 1988, but tuberculosis (TB) remains a scourge; it kills 2 million people a year, most with HIV/AIDS. In his chronicle of TB's trajectory from the start of the twentieth century, historian Christian McMillen probes our failure to control this "resilient, powerful, protean bacterial infection" and its drug-resistant strains. Tracing the swathe TB has cut through Africa, India and Native American areas, McMillen identifies the catalogue of errors keeping it in circulation — such as the closure of the UK Medical Research Council's TB units in 1986, just as Africa's struggle with HIV began.

Secret Science: A Century of Poison Warfare and Human Experiments
Ulf Schmidt OXFORD UNIVERSITY PRESS *(2015)*
This monumental history of twentieth-century military medical ethics is a meticulous record of ambiguity. Historian Ulf Schmidt shows how Germany's use of chemical weapons such as mustard gas in the First World War spurred Britain, Canada and the United States to begin secret toxic-agent trials that purported, in some cases, to be benign medical testing. At the UK Porton Down research centre alone, Schmidt reveals, 21,752 soldiers took part in tests between 1939 and 1989 — an experience that was frequently unpleasant, occasionally harmful and in a few cases fatal.



A Dangerous Master: How to Keep Technology from Slipping Beyond Our Control
Wendell Wallach BASIC *(2015)*
Hordes of technologies emerge in lockstep with warnings of their risks. Ethicist Wendell Wallach sorts the hysteria from the hazards in this magisterial study. He looks in turn at disruption, complex systems, problematic trade-offs, the "transhumanism" movement — and new forms of governance to guide us through the innovatory onrush. It is conscious engagement, Wallach argues, that will allow us to resist the truly dangerous developments that threaten to "woo us to sleepwalk into the technological wonderland".



Let's Be Less Stupid: An Attempt to Maintain My Mental Faculties
Patricia Marx TWELVE *(2015)*
Struggling with brain fog? This "sub-primer" on the neuroscience of intelligence and memory by *New Yorker* staff writer and master humorist Patricia Marx delivers salutary cognitive jolts amid the general hilarity. Through a "higgledy-piggledy assortment of highfalutin science, lowfalutin sciences, tests" and more, Marx explores memory slippage, mindfulness, the Cherokee language and brain scans. If you regularly arrive in rooms with no memory of what you were looking for, this one is for you. **Barbara Kiser**