► of national-insurance programmes and philanthropy. People with joint and bone TB, often children, underwent orthopaedic treatments, such as wearing shells and jackets that left just face and ears exposed.

In 1921, as Bynum reveals, Albert Calmette and Camille Guérin devised the first breakthrough: the vaccine bacille Calmette–Guérin (BCG). Twenty years later, Albert Schatz and Selman Waksman discovered the second: the TB drug streptomycin. Intensive research spawned others, and the 1950s saw the first broad-scale fight against TB, with mass X-ray screening and drug therapy. But although national TB-control programmes sprang up, interrupted treatments and poor patient compliance led to drug resistance, notably in regions of conflict and asylum camps. From the beginning, resistance against single drugs was noted, and clinical trials spearheaded by the UK Medical Research Council revealed that multi-drug therapy was essential for preventing the development of drug-resistant strains.

A rigorous multi-drug treatment programme led by the World Health Organization (WHO) effectively defeated non-resistant TB, but about 50 million people currently harbour multi-drug-resistant tubercle bacilli. Of these, nearly half a million develop the disease each year. With around 15 million people co-infected with HIV and tubercle bacilli, and nearly 1 million active TB cases a year among people with HIV, we are seeing a perfect storm. If Bynum's book has a weakness, it is that it lacks an outlook on how the WHO's goal to eliminate TB by 2050 could be achieved.

Spitting Blood provides impressive insight into TB as a medical and social disease. Meanwhile, photographer James Nachtwey's gallery of people with drug-resistant TB (www.xdrtb.org) complements this work on a disease that is still very much with us. In 2009, London alone harboured nearly 3,500 TB cases: an almost 50% increase over the preceding decade. ■

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A More Perfect Heaven: How Copernicus Revolutionised the Cosmos

Dava Sobel (Bloomsbury, 2012; £8.99)

Mixing drama with history, Dava Sobel offers a biography of Copernicus with a twist, working in a two-act play in which a student convinces him to publish his revolutionary work. (See Owen Gingerich's review: *Nature* **477**, 276–277; 2011.)

Margaret Sanger: A Life of Passion

Jean H. Baker (Hill and Wang, 2012; \$17.00)

Margaret Sanger emerges as a daring and determined character in historian Jean Baker's vivid life. Sanger's fervent belief that women should be able to limit the size of their families led to the development of the contraceptive pill. (See W. F. Bynum's review: *Nature* **478**, 318; 2011.)

PLANETARY SCIENCE

The search for Earth's twin

Sara Seager enjoys a frank and vivid account of planet hunting.

People have pondered the existence of Earth-like worlds beyond our Solar System for millennia. In 1995, the first exoplanet was spotted, orbiting a Sun-like star. Fewer than two decades later, hundreds of planets and thousands of candidates are known. Yet the sheer variety of exoplanet masses, sizes and orbits indicates that close copies of the Solar System are rare.

In *Mirror Earth*, science writer Michael Lemonick relates astronomers' abiding interest in sister worlds, from ancient Greece — where Aristotle surmised that there is only one world, Earth — to today, and beyond. Spotting a small, light and faint planet near its massive, bright host star is difficult and requires abstruse techniques. Lemonick sets out these methods — radial velocity, transits, microlensing, direct imaging, astrometry and pulsar timing — with impressive clarity.

NASA's Kepler space telescope is rightly a focus of the book. The Kepler mission's goal is to establish how common Earth-size planets in Earth-like orbits about Sun-like stars are. But, as Lemonick is careful to spell out, these will not necessarily be Earth 'twins' — planets with water oceans, continents and thin atmospheres conducive to life.

Knowing a planet's size doesn't tell us whether it is habitable. Venus, for example, is about the same size as Earth but not at all Earth-like. A thick carbon dioxide atmosphere causes greenhouse heating of the surface to temperatures exceeding 700 kelvin, hot enough to melt lead.

The Kepler telescope, launched in March 2009 and trailing Earth as the planet orbits the Sun, is making astonishing discoveries. One is that 'mini-Neptunes' — planets a few times Earth's diameter and a little smaller than Neptune — are many times more common than larger 'Jupiters', planets about 11 times the size of Earth. There are hints that smaller planets may be even more numerous. This tantalizing finding could

imply that rocky planets (thought to reach no more than 1.75 times Earth's size) outnumber their gas-rich cousins.

Kepler has also vastly increased our knowledge of the variety of planetary systems. These include single planets orbiting two suns and dozens of multiple-planet systems, some in surprisingly compact orbits. The book covers the zoo of planetary types thought to exist, as well as theories of planet formation, conditions for habitability and the origin of life.

Lemonick describes Kepler's rocky road from conception to launch, including how its technical feasibility was repeatedly challenged, leading to the proposal being rejected by NASA several times. And he discusses the implication of the recent realization that most Sun-like stars are more variable than our Sun. That means Kepler must scour them for twice as long to pick out the signature dimming of

KNOWING A PLANET'S SIZE DOESN'T TELL US WHETHER IT IS HABITABLE.

passing planets, doubling the time it will take to reach the census goal.

Finding exoplanets is an art as well as a science, and Lemonick gives examples to demonstrate how hard it can be to tease a weak signal out of data. "It's my Rembrandt," declared exoplanet hunter Paul Butler of his computer code — six years in the making — that cracked the puzzle of how to measure the precise motion of a star caused by an orbiting planet. Controversy invariably follows about which detections are robust,

Mirror Earth: The Search for Our Planet's Twin

MICHAEL D. LEMONICK
Walker: 2012. 304 pp.
\$26, £19.99

and Lemonick captures some of those lively exchanges with quotes and stories.

Lemonick provides a brutally honest character exposition of well-known exoplaneteers. He details Geoff Marcy's feelings of being, in Marcy's words, "an impostor" early in his career owing to a severe lack of confidence that plagues many young scientists, and Debra Fischer's unusual route into astrophysics via nursing.

One intriguing thread in the book is the tension between scientists and journalists. Exoplanet discoveries are ripe for misinterpretation and exaggeration. The media and the public want an exciting story even when there is none, and it is easy for a scientist to get caught up in the hype. Lemonick describes how one astronomer felt he was induced by a journalist to say that "the chances for life" were "100 percent" on a new planet, the very existence of which is now challenged.

Mirror Earth captures the excitement of planet hunting and the ups and downs of discovery. Yet today, the quest for an Earth twin remains just out of reach. To identify a truly Earth-like world will require a more sophisticated space telescope than Kepler, to look for water and signs of life. Lemonick speculates on how that might happen. It may take decades to see how the story really unfolds. Stay tuned. ■

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World in the Balance: The Historic Quest for an Absolute System of Measurement

Robert P. Crease (W. W. Norton, 2012; \$17.95)
From weighing out food to telling the time, we have long sought to measure experience. Robert Crease traces the origins of such rules, which now seem "part of the contour of things". (See Andrew Robinson's review: *Nature* 478, 32–33; 2011.)

The Abacus and the Cross

Nancy Marie Brown (Basic Books, 2012; \$16.99)
The idea that anti-scientific superstition defined the Middle Ages is challenged by science writer Nancy Marie Brown in this life of 'Scientist Pope' Gerbert of Aurillac. Gerbert devised early forms of the computer and the planetarium, and his teaching helped spread science through Europe.