Making magic bullets

Miracle Cure

by William Rosen

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In 1907, Paul Ehrlich coined the term ‘magic bullet’, that is, a bullet that would hit its target without fail and with no collateral damage to the surrounding environment. He was talking about a, at the time, hypothetical drug that could target an invading pathogen without killing or damaging the host it was infecting. In *Miracle Cure*, William Rosen takes us on a journey from the dark ages of medicine through to the birth of modern medicine, driven by the discovery of such magic bullets in the form of antibiotics.

Context is everything. It is perhaps only by realizing the gravity of the situation in the pre-antibiotic era that we can truly appreciate the value of our magic bullets. Rosen opens with some frankly horrific stories of historic medical interventions, including removal of 60% of the patient’s blood volume to treat disease, and treating syphilis and other ailments with mercury. In these cases, the ‘treatments’ almost certainly did more harm than good, but such strategies were common in an age before the basis of disease, particularly infection, was understood.

So, to say that medicine has come a long way since those days is something of an understatement. Rosen describes this journey by telling the stories of the godfathers of microbiology (including the likes of Pasteur, Koch, Lister, Ehrlich) but discusses them not just as scientific trailblazers, but also as eccentric characters. Of course, he discusses their scientific brilliance and how they revolutionized how we think about infectious diseases, but he also tells us the gossip — the difficult scientific relationships. For example, Fleming, Florey and Chain, who eventually shared the Nobel prize in physiology or medicine for the discovery and isolation of penicillin,

had a decidedly rocky relationship, the details of which are well-documented in the book for us to enjoy. It is also heartening to learn that Florey and Chain too struggled to find sufficient grant funding — if the real brains behind one of the greatest medical innovations in history were at times strapped for cash then there is hope for us all!

A theme that Rosen returns to throughout the book is the impact (both positive and negative) of World War II on the development of antibiotics. In many ways, progress was understandably slowed. Funding, resources and man-power were scarce and collaborative opportunities limited for developing magic bullets when so much effort was being diverted into producing and using bullets of a different kind. There was a reluctance to share strains and information with certain people or organizations in case it resulted in giving aid to the enemy. However, the drive to treat infected battle wounds and keep the troops ‘battle ready’ provided the much needed enthusiasm for public money to be used to drive the industrialization of penicillin production. For example, in 1943, Churchill donated government funds to allow the United Kingdom to keep pace with the United States and produce enough penicillin for the allied troops on D-day. The beleaguered public were also primed to embrace a life-saving miracle drug.

Rosen argues convincingly that the antibiotic revolution and particularly the need to industrialize penicillin production (the so-called penicillin project) drove the formation of the pharmaceutical industry as we know it and was the driving force that founded some of the most profitable companies in history. For companies that got a contract as part of the penicillin project, it was a game changer. With profit margins of up to 27%, antibiotic production made pharmaceutical industry companies some of the most profitable businesses in the United States. However, for some there was a sting in this tale, and *Miracle Cure* charts the rise and fall of some of these companies. For example, Parke-Davis owned the patent and rights for the drug now called chloramphenicol, which in 1951 represented half of all prescriptions for broad-spectrum antibiotics. On the back of this, Parke-Davis became the

largest pharmaceutical company in the world, making US\$55 million a year from chloramphenicol alone. However, the linkage of this drug as a cause of the deadly condition aplastic anaemia spelled near economic disaster.

The book also covers more recent developments, discussing how the fast pace of discovery during the golden age of antibiotic development is in stark contrast with the low number of new drugs developed in the last decades. New antibiotics that kill bacteria but do not harm the host are hard to come by, and the cost of turning these into drugs is huge. Big pharma has all but pulled out of new antibiotic development in favour of more profitable alternatives, which is somewhat ironic given that antibiotics were its foundation. As Rosen puts it: “Antibiotics built virtually every modern pharmaceutical company but are now barely a rounding error in the industry’s balance sheet.”

Antibiotics have undoubtedly changed the world. They have saved millions of lives and are one of the bases on which modern medicine was founded. However, as we are all too aware, bacteria continue to outsmart our efforts to kill them and antibiotic resistance is an ever-increasing problem. The book does not really deal with the threat of resistance in any meaningful way until the epilogue. Here, Rosen touches on the problems of resistance and some of the infectious diseases that are once again becoming hard to treat, such as *Staphylococcus aureus* infections (that is, MRSA) or tuberculosis. This is of course confounded by the lack of new drugs. Without swift, coordinated global action we risk a return to the pre-antibiotic age where ‘simple’ infections are deadly. Clearly, in the modern age, this would not be a return to a world of blood-letting and mercury treatment. But on considering the reality of a post-antibiotic world, Rosen concludes that it would actually be, in many ways, worse: we will know and understand exactly what is killing us, but still be unable to do anything about it. □

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