



Medicine in the Antibiotic Apocalypse

Review of *Surgeon X*; John Watkiss and Sara Kenney; (2017). Image Comics, Inc., Portland, Oregon. 208 pages.

Set in the near-future London of 2036, *Surgeon X* examines the question: when pathogens resist all antibiotics, what next? The novel, funded by the Wellcome Trust, presumably to promote conversation on antibiotic resistance and a post-antibiotic world, could fit into an undergraduate course that discusses antibiotic resistance.

The novel is fast-paced, with a strong plot to hold student interest, and topics covered lend themselves to discussion of important issues, described below. However, there are a number of problems with the novel the instructor may want to consider. The book moves between characters and locations very rapidly, and with a number of secondary characters, it is sometimes difficult to keep track of everyone. More concerning, protagonist Rosa Scott's brother Lewis has schizophrenia, and his paranoid delusions become more pronounced as he stops taking his medicine. Lewis is referred to as "crazy" and "psychotic," which I found unnecessary and distracting. The novel also has a British focus and inside jokes, discussing King Charles' views on complementary medicine and advocacy of homeopathy, for example, which will probably go over many non-British heads.

The initial six-chapter storyline opens with a political fight over antibiotic restrictions. As antibiotics have largely failed and antibiotic-resistant infections are responsible for 9 million deaths a year in Britain, who should be able to access the dwindling supply of remaining effective antibiotics? Chaos reigns as individuals are denied treatment and rise up against the law. Rosa Scott is a surgeon, a medical vigilante, and the daughter of a microbiologist who wanted "to save the world." As a rogue surgeon, she has a philosophical crisis about the nature of her work and whether life itself is a privilege or a right.

Setting her story in the larger context of a government conspiracy and murder mystery, author Sara Kenney weaves the issues expected in the post-antibiotic era into an engaging story. There are brief vignettes discussing the history of antibiotic discovery, how over-use of antibiotics and a lack of investment in new drugs led to the crisis, and what that

means for the year 2036. Many of these are conveniently added as lectures by Martha, a microbiologist and Rosa's sister. Phage therapy and the search for new antibiotics are also alluded to, and any of these vignettes could be used to prompt student discussions in a course. For example, how realistic is the portrayal of the "post-antibiotic era" in the comic? What challenges might individuals working on phage therapy or antibiotic development face?

Further, the "bad guys" are the Lionheart Party, described as right-wing fascists, who favor rationing and sponsored the Antibiotic Preservation Act. While any rationing would naturally be fraught with various ethical landmines, it seems likely that some kind of prioritization would be necessary in the case of limited resources, as has already been discussed with antiretrovirals (1) and vaccines (2). This could serve as a point of discussion in class: is rationing rational? If healthcare professionals supported rationing, would the public acquiesce? What would be the benefits or possible harms to society if antibiotics needed to be rationed?

Though others have used graphic novels in education (3) and outreach (4), it is difficult to assess the success of this approach. A previous publication suggested the use of graphic novels could enhance understanding of material (5). The Centers for Disease Control recently released a zombie graphic novel to raise awareness of disaster preparedness, but at least one study suggested it did not work as hoped (6) and could even backfire in some aspects (7). Whether *Surgeon X* will appeal to the masses is uncertain, but I recommend it as a useful addition to a Biology instructor's repertoire as a novel way to consider issues regarding the potential post-antibiotic future.

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