



Learning from the Past: A Scientist's Take

Kelvin Li '21

A Book Review on *Pandora's Lab*

Author: Paul Offit, MD, Maurice R. Hilleman Professor of Vaccinology at the Perelman School of Medicine at the University of Pennsylvania and the Director of the Vaccine Education Center at The Children's Hospital of Philadelphia.

Published: April 4th, 2017 by National Geographic Society

Science has been failing us for as long as humans have existed. Paul Offit's aptly named *Pandora's Lab* tells the stories of notable failures. The book is many things at once: a study of the questionable history of some brilliant ideas, a cautionary tale on the unintended consequences of hasty conclusions, and a series of crisp lessons to aid the modern citizen in navigating the controversial landscape of scientific advances. Offit tells seven tales of scientific discoveries that, once unleashed, resulted in horrible consequences. Written in a way that is accessible to both the avid science enthusiast and the casual non-scientist, *Pandora's Lab* is thought-provoking and perhaps a little controversial. He does more than give short lessons at the end of each story; Offit also applies them to topical subjects in his final chapter. It's a worthy read for anyone who's interested in learning about the history of science and understanding how to parse through the overwhelming abundance of scientific information circulating the globe.

The book's title might suggest that it would contain a series of anecdotes about lab accidents or operating table mishaps, which would be interesting, but unsubstantial. Rest assured, however, that this is far from the case. For example, Offit's chapter on Fritz Haber and the nitrogen revolution, the story of how one man simultaneously helped billions of people and inflicted an inexcusable amount of suffering. Haber, a German chemist, developed the machinery and process for converting the major component of air, nitrogen gas, into fertilizers. This achievement, which vastly increased agriculture productivity and thus allowed over three billion more people to live on Earth, earned Haber a Nobel Prize.

However, Haber's work also brought death and destruction in numerous ways. Offit writes about Haber's patriotism, which led him to develop gas weapons that were used during World War I and the Holocaust despite protests from his wife and fellow scientists. The revolutionary Haber-Bosch process was itself a cause of tragedy as well. Offit details the massive levels of pollution that have resulted from the introduction of nitrogen into the global waterways, concluding that "everything has a price, the only question is how big." This is a sentiment that pervades the book: each of the cases discussed has affected millions if not billions of people.

The other tales in this book each illustrate different points. There are stories illustrating the importance of data, tales warning against letting personal views cloud scientific judgement, and accounts demonstrating the benefits of moderation. Their subjects range from millennia old medicines to 20th century prejudices and include applications to modern issues in science.

One such issue is the United States' growing opioid epidemic,



which Offit describes as the leading cause of accidental deaths in the United States. We learn that this double-edged pain-relieving sword originated in Sumerian civilization during the 4th millennium BCE, and that though addiction has existed since that time, it wasn't until the 19th century that scientists started addressing it. First it was morphine in 1803, then the hypodermic syringe in 1853, then heroin in 1898 followed by Percocet in 1976 and OxyContin in 1996. Each time, well-meaning scientists eagerly claimed that the new product would cure addiction, but because the studies they conducted tracked only a few patients over a short amount of time, their conclusions were flawed. The moral of this story, according to Offit, is to make sure that there is enough quality data to back up conclusions. That sounds simple, but as history has shown, it's not easy advice to follow.

What Offit does particularly well with his chapter on opioids is to, in a sense, follow his own lesson. He gives many examples blending historical accounts and scientific papers that each show the same thing: opioid addiction arising due to premature conclusions by scientists. I liked that he took care to place blame not on individual scientists but on public pressure that biased the scientists to expect positive results. By separating scientists from their work and showing how they can avoid repeating historical mistakes, Offit expresses hope for a solution to the opioid epidemic.

In one of his more controversial chapters, Offit is optimistic about the future of pesticides, and argues for moderation in its use. Offit argues that Rachel Carson's book *Silent Spring* ended up doing more harm than good. He claims that due to the indefinite moratorium placed on DDT (the pesticide at the center of Carson's book) by the Environmental Protection Agency and later the World Health Organization, malaria and the mosquitos that carry its causative agent spread uncontrollably. This zero-tolerance policy is slowly being overturned, however, and Offit believes that malaria will decline in turn. My problem with his argument is that the loss of DDT was not the only reason for malaria's spread. For one, DDT's effectiveness compared to other pesticides was vastly decreased because for the most part, the mosquito vector did not rest indoors where chemical

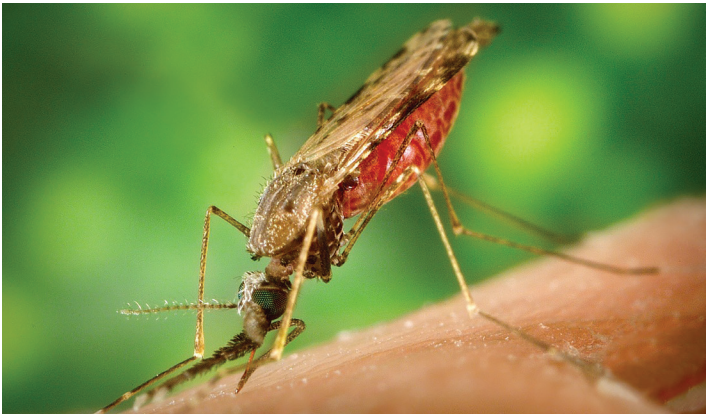
pesticides were most effective (Packard). Additionally, widespread drug resistance in the malaria parasite has played a large role in the spread of malaria (Packard). It isn't fair to say that banning DDT was the sole reason for the surge in malaria cases and fatalities.

However, that is not to say that I disagree with everything in this chapter. Quite the contrary, I thought that Offit's argument regarding Carson's lack of scientific training and the EPA's research suppression were accurate and relevant to science today. When it came time for the EPA to decide DDT's fate, they had two bodies of evidence. On one hand was a large multi-disciplined study that demonstrated no correlation between DDT and toxic effects on a wide variety of wildlife. On the other hand, was Carson's book, which appealed to the public because of its lyrical writing, but cherry-picked anecdotes and used unreliable sources for observations. The EPA ended up taking Carson's stance, going so far as to prevent some of the research debunking her conclusions from being published. Offit is right to denounce the EPA's censoring because science can only progress with open dialogue.

One aspect of open dialogue is proper interpretation of data, and to illustrate this point Offit tells the dark story of the eugenics movement. Offit vividly describes the horrifying experiments that Nazi doctors performed on children, all in the name of bettering humanity. What enabled such atrocities to occur, according to Offit, were years' worth of statistics that policy-makers misinterpreted to support such discriminatory practices. What I particularly like about this chapter is how Offit adds nuance to generally accepted historical narratives. In doing so, he implores readers to critically examine other cases in which misinterpretation of scientific results enabled intolerable historical practices.

To make this chapter on eugenics more relatable, Offit creates a hypothetical example that applies to 2018. He writes of an imaginary paper published in 2016 in a top medical journal (he does not give a name) claiming that people living in Mexico have genes that are shown to predispose them to violent behavior. He goes on to imagine how politicians could take the conclusion of the hypothetical study





and use it as evidence to restrict Mexican immigration. Despite the apparent absurdity of the example, Offit says that this misinterpretation of data is exactly what allowed proponents of eugenics to support their erroneous views. His lesson for this chapter is to avoid letting personal beliefs bias the interpretation of data.

Offit masterfully ties his whole book together with a concluding chapter discussing vaccines, e-cigarettes, GMOs, and cancer screening programs among other modern scientific controversies (though some, like vaccinations, are shown not to be controversies among scientists at all). By taking the lessons he espouses throughout the book and applying them to these modern situations, Offit engages the reader and makes them think about and perhaps question their personal stances. Offit presents his own stance on these subjects and supports his views with a book’s worth of anecdotes. However, he continues to emphasize the importance of not blindly accepting scientific conclusions, even his own.

A worthy read for anyone who’s interested in learning about the history of science

Pandora’s Lab is a much-needed addition to modern discourse, especially given its tendency to politicize science. Offit aims to equip readers with the tools to productively engage with challenging scientific topics in a way that is analytical but bias-free. He makes it clear that science goes wrong when external factors such as industrial pressures or emotions interfere with the collection and interpretation of data and results. He makes readers think not just about history but also about how to find the truth in modern controversies. Ultimately, Pandora’s Lab equips readers with snappy tips on how to make the best use of the information flying at them in the modern day.

References

(1) Packard, R.M. The Origins of Antimalarial-Drug Resistance. N. Engl. J. Med. 2014, 371, 397-399.