

Science and Culture: Oppenheimer goes center stage

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J. Robert Oppenheimer, ambitious leader of the Manhattan Project, struggled with intense ethical dilemmas. To continue to work on the atom bomb, he had to abandon his communist friends in order to prove to military monitors his loyalty to the US government. Later, Oppenheimer faced the moral implications of the project's success. His struggles with ambition, betrayal, and moral quandaries made Oppenheimer positively Shakespearean, says playwright Tom Morton-Smith.

It's fitting, then, that Morton-Smith's *Oppenheimer* was developed and staged at the Royal

Shakespeare Company's Swan Theater in Stratford-upon-Avon, England, the Bard's hometown. The play, which follows the physicist from academia in Berkeley, California, to the Los Alamos, New Mexico military facility where the bomb was born, ran January 22 to March 7, 2015. Despite the title, the play's scope goes beyond one man, as it explores the moral quandaries that multiple scientists faced as they built the ultimate weapon.

Morton-Smith is not the first to portray nuclear physicists on stage. Michael Frayn's Tony award-winning *Copenhagen*, which

debuted in 1998, depicted a fictional meeting between physicists Niels Bohr and Werner Heisenberg in the titular city. Science can, of course, be complex and difficult to explain concisely, but the tools of the stage can help. In *Copenhagen*, the actor playing Heisenberg acts out the part of a photon, while Bohr and his wife Margrethe take on an electron and the nucleus, respectively. *Oppenheimer's* cast, in a nod to their Shakespearean theater surroundings, use asides or direct address to explain nuclear physics to the audience.

To get *Oppenheimer's* science spot-on, the show's director, Angus Jackson, recruited his former University of Oxford physics professor, Dave Wark. Armed with 41 densely worded PowerPoint slides, Wark visited the theater for



Oppenheimer places the Manhattan project leader's struggles on stage as part of a production by the Royal Shakespeare Company's Swan Theater in Stratford-upon-Avon. Image courtesy of the Royal Shakespeare Company.

a workshop during the play's development. He explained to Jackson, Morton-Smith, and their workshop cast the exponential nature of a nuclear chain reaction with an Indian parable about a king and a sage betting on a chess match. The sage suggests that if he wins, the king will place one grain of rice in the first square on the board, two in the second, four in the third, and so on up to the 64th square, and then hand over the sum. Only after his defeat does the king realize that the exponential increase means he owes more rice than he can ever pay. Morton-Smith liked the explanation so much, he put it in the play. "I had this bizarre, and very flattering, experience of seeing J. Robert Oppenheimer quote me," Wark says.

Getting the science right matters, but story and characters come first, says Morton-Smith. *Oppenheimer* includes only the science needed to advance the plot. That meant leaving things out, like a section he drafted—then scrapped—on the layout of an atom and the empty space therein. In other cases Morton-Smith strove to simplify without losing accuracy. For example, the actors explain deuterium as "heavy hydrogen."

Wark was pleased to help out with these scientific details, but even more proud of his

advice on the people in the project. Wark earned his doctorate at the California Institute of Technology in Pasadena and did postdoctoral work at Los Alamos National Laboratory, a pedigree that allowed him to study under or meet several Manhattan Project veterans. He refers to Richard Feynman as "Dick" and could tell Jackson and Morton-Smith what those scientists were really like, and what they thought of their role in building the weapon they called "the gadget." At the time, they saw the atom bomb as an efficient device to destroy cities, which the Allies were doing anyway.

In Morton-Smith's first draft, Hans Bethe came off as "sharpish and excitable," Wark says, and the dialogue and actions of Oppenheimer's students suggested they were less than enthusiastic about meeting him. In fact, Wark explained, the man was even-tempered and revered for his work on three papers, dubbed the "Bethe Bible" of nuclear physics (1–3). In Morton-Smith's final script, the students ask Bethe for his autograph.

Oppenheimer is part of a long tradition of science on stage, notes Michael Billington, theater critic for United Kingdom newspaper *The Guardian*. Christopher Marlowe's *Doctor Faustus*, published in 1604, touches on scientific questions, and Bertolt Brecht's *Life of Galileo* was penned in 1938, revised 1945, and onstage in a major production as recently as 2003 (4). Friedrich Dürrenmatt wrote the satiric *The Physicists* in 1961; chemist Carl Djerassi wrote several plays incorporating themes about science and scientists. This past January, Tom Stoppard's new work on the nature of consciousness, *The Hard Problem*, premiered at the National Theater in London. And in September, Nicole Kidman will play DNA double helix researcher Rosalind Franklin in the play *Photograph 51*.

"Science, and particularly physics, is all about looking at how the universe and the world work," says Morton-Smith. "That's what theater is supposed to do, too."

1 Bethe H, Bacher R (1936) Nuclear physics. A: Stationary states of nuclei. *Rev Mod Phys* 8(2):82–229.

2 Bethe H (1937) Nuclear physics. B: Nuclear dynamics, theoretical. *Rev Mod Phys* 9(2):69–244.

3 Bethe H, Livingston MS (1937) Nuclear physics. C: Nuclear dynamics, experimental. *Rev Mod Phys* 9(2):245–390.

4 Sheperd-Barr K (2012) *Science on Stage: From Doctor Faustus to Copenhagen* (Princeton Univ Press, Princeton, NJ).