On 1 August 1790, a precocious student named Victor Frankenstein submitted a radical proposal to an ethical panel at the University of Ingolstadt in Bavaria. Under the title “Electro-chemical Mechanisms of Animation,” Frankenstein explained how he wanted to “reverse the processes of death” by collecting “a large variety of human anatomical specimens” and putting them together to try and “restore life where it has been lost.” Frankenstein assured the institutional review board (IRB) that he had the highest ethical standards. “If I do succeed in fully animating a human or human-like creature, I will provide the creature with information about the study and allow it, if it is capable, to choose whether or not to participate further in continued observation and study,” noted the budding scientist. If the creature had “diminished capacity,” Frankenstein promised to bring in a third party to act in its interest and treat “the being” in accordance with recognized standards.

Of course no such proposal ever went to bioethicists at the University of Ingolstadt, where the fictional Frankenstein created his monster. In 1790, even a real Frankenstein would have faced no ethical reviews. But the proposal does exist in a 2014 paper, which speculates about whether the Frankenstein story would have had a happier ending if 21st century safeguards had existed 2 centuries ago. It is one of many riffs on the novel to be found in biomedical literature. In conceiving her story, Mary Shelley was influenced by the nascent medical science of the day and by early experiments on electricity. In return, Frankenstein has haunted science ever since.

First published anonymously in 1818, the book and subsequent films and plays have become what Jon Turney, author of the book Frankenstein’s Footsteps: Science, Genetics and Popular Culture, calls “the governing myth of modern biology”: a cautionary tale of scientific hubris. And as with all long-lasting myths, it is not one myth, but many, as a search for “Frankenstein” in the PubMed database—the main catalog of life sciences papers—makes clear. Scientific literature, like the popular press, is rife with references to Frankenfood, Frankencells, Frankenlaws, Frankenswine, and Frankendrugs—most of them supposedly monstrous creations. Other papers explicitly mentioning Frankenstein—there are 251 of them—analyze the science behind the novel or even, in a twist that can be downright bizarre, draw inspiration from it.

Several reports in psychological journals delve into the state of mind of its author when she first imagined the tale during the summer of 1816. Then Mary Wollstonecraft Godwin, she was visiting the poet Lord Byron at Villa Diodati, a mansion he had rented on the shores of Lake Geneva in Switzerland. She was 18, accompanying her married lover, the poet Percy Bysshe Shelley. Her stepsister, Claire Clairmont, was there, as was Byron’s live-in doctor, John William Polidori. It was the “year without a summer,” a climatic anomaly caused by the eruption of Mount Tambora in the Dutch East Indies, and endless rain and gray skies kept the guests cooped up. Byron suggested as a party game that they each write a ghost story.

There was plenty to unsettle Mary’s fertile mind. Mary and Percy had a 6-month-old baby together, but had lost another baby a year earlier. Mary’s own mother had died of puerperal sepsis 11 days after giving birth to her fame-bound daughter. Percy, as a 2013 paper in Progress in Brain Research recounts, had been booted from the University of Oxford in the United Kingdom for “extolling the virtues of atheism” and was a believer in “free love.” Another paper, in a 2015 issue of The Journal of Analytical Psychology, suggests that Percy, Mary, and Claire had previously formed “a ménage à trois of sorts.”

The Journal of Analytical Psychology paper’s author, Ronald Britton, a prominent psychoanalyst, links these tensions and griefs to the daydream in which Mary Shelley first envisioned Frankenstein’s monster—“the spectre which had haunted my midnight pillow,” as she later put it. The “background facts to her nightmare,” Britton writes, invoking Freud, “opened a
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that swapped the eyes, noses, and mouths of former President George W. Bush and former U.S. Secretary of State Colin Powell. A “Frankenrig” used to create 3D animations, made by mixing and matching bones from different skeletons.

In perhaps the strangest embrace of the Frankenstein label, a 2013 article in *Surgical Neurology International* proposes recreating Aldini's electrifying head experiments. The authors of “HEAVEN: The Frankenstein effect,” note that Aldini ultimately aimed to transplant a human head, using electricity to spark it back into awareness. That's just what the authors have in mind for their project, the head anastomosis venture (HEAVEN). “On the whole, in the face of clear commitment, HEAVEN could bear fruit within a couple of years,” they write. (Many scientists have called the project unfeasible and unethical, but last November, two of the co-authors announced to the media that they had performed a head transplant on a human corpse and soon planned to publish details.)

But by far the bulk of the scientific literature hand-wrings, ponders, and philosophizes about the most familiar form of the Frankenstein myth, which Shelley flicked at in her “Modern Prometheus” subtitle: the idea that mad scientists playing God the creator will cause the entire human species to suffer eternal punishment for their trespasses and hubris.

“Mary Shelley, Frankenstein, and The Dark Side of Medical Science,” a 2014 essay published in the charmingly incongruous *Transactions of the American Clinical and Climatological Association*, ticks off a diverse list of recent experiments that have drawn the “Franken-” label: the cloning of Dolly the sheep, the engineering of a highly lethal H5N1 bird influenza that could more easily infect mammals, the synthesizing of an entire bacterial genome. Other triggers of Frankenstein-ish fears have included in vitro fertilization, proposals to transplant pig organs into humans, and tomatoes endowed with genes from fish to make them freeze-tolerant.

J. Craig Venter, a pioneer in genomics based in San Diego, California, has been called a Frankenstein for his effort to create artificial bacteria with the smallest possible genomes. Still, he’s a fan of Shelley’s tale. “I think she’s had more influence with that one book than most authors in history,” says Venter, who owns a first edition. “It affects a lot of people’s thinking and fear because it represents this fundamental of ‘You don’t mess with Mother Nature and you don’t mess with life because God will strike you down.’”

“Oh, obviously, I don’t buy into that theme,” he adds.

The Frankenstein myth endures, he says, because “fear is easy to sell”—even when unwarranted. “Most people have a fear of what they don’t understand,” he says. “Synthetic cells are pretty complicated and putting a new gene into corn sounds scary.” But by throwing around labels like Frankenfood and Frankencells to rally the public against potentially valuable innovations, he says, the “fear-based community will potentially do more damage to humanity than the things they fear.”

Unlike the Frankenstein character, who initially didn’t consider how his work might go wrong, Venter says he recognizes that editing and rewriting genomes could “contaminate the world” and cause unintended harm. “I think we need to be very smart about when we do it and how we do it,” he says. He thinks Shelley “would highly appreciate” his work.

Henk van den Belt, a philosopher and ethicist at Wageningen University in the Netherlands who wrote a paper about *Frankenstein* and synthetic biology, applauds Venter for fighting back against the Frankenslur. “Very often scientists are afraid to take this position, but I think it's better to be defiant,” Van den Belt says. “Rhetoricians and journalists can accuse people of playing Frankenstein, but it's a little too easy. If scientists challenge this phrase, it will have less impact.”

Shelley of course couldn’t have imagined any of this hubbub, and indeed her tale has been wildly distorted in the popular imagination over the past 2 centuries. Frankenstein’s aim was not to rule the world à la Dr. Evil, but “to banish disease from the human frame and render man invulnerable to any but a violent death.” And Britton, the psychoanalyst, notes that the creature did not begin life as a monster; he only went on a killing spree because he sought love and happiness but was abhorred by his creator, who referred to him as “devil,” “fiend,” “abortion,” “daemon,” “vile insect,” and other terms that would have made an IRB contact the Office for Human Research Protections. “I was benevolent and good, misery made me a fiend,” Frankenstein's creation said. “[T]he impotent and bitter indignation filled me with an insatiable thirst for vengeance.”

A dental radiologist of all people published an insightful two-part essay in *The Journal of the Royal Society of Medicine* in 1994 that underscores what some argue is the real moral of the book: not the danger of scientists violating the natural order, but the dire fate that awaits creators who fail to care for their creations. “Read the book and weep for those we have rejected, and fear for what revenge they will exact, but shed no tears for Frankenstein,” the essay advises, referring to the doctor. “Those who think, in ignorance of the book, that his is the name of the Monster are in reality more correct than not.”
How a horror story haunts science
Jon Cohen

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