ANNALS OF TECHNOLOGY

OBJECT OF INTEREST: THE TWICE-FORBIDDEN FRUIT

By Patrick House

May 13, 2014

Last year, Joe Davis, the artist in residence at George Church's genetics lab, at Harvard Medical School, received an unmarked package containing

roots and leaves from a four-thousand-year-old strain of apple. The contents in the box represented the closest thing that Davis could find, after years of searching, to the forbidden fruit that grew in the Garden of Eden. He plans to use synthetic biology to insert a DNA-encoded version of Wikipedia into the apple and create a living, literal tree of knowledge.

Davis, who is sixty-three, stands on an aluminum peg leg fitted with a rubber stopper that was meant, originally, for a laboratory flask. When you talk to people who have met him, you end up hearing versions of the same stories: that he put clock parts in an incubator for twenty-five years to see if, like life, they would self-assemble; that, in 1986, he was the first to insert art into the genome of a living organism; that he lost his right leg below the knee when he "kissed an alligator"; that he is reëngineering silkworms to spin gold; and that he won a Rockefeller grant for designing, in his home state of Mississippi, after Hurricane Katrina, a hundred-and-six-foot-tall steel tower that captured lightning strikes and hurled them back, in protest, at the sky.

Davis has titled the apple project "Malus ecclesia." (*Malus*, the genus name for all apples, means both "bad, evil" and "apple tree" in Latin. *Ecclesia* translates to "church"—an homage, Davis said, to George Church.) The project should stretch his already considerable ambitions. The apple genome can be thought of as a seven-hundred-and-fifty-million-letter book, made of the four letters of DNA: a, t, c, and g. The process of inserting Wikipedia resembles taking a pen and writing in the margins and between the lines. All the original text is retained, and all the genes that make the apple apple-like will be spared, with the goal, Davis said, of ecological and biological friendliness: "I don't want it to make any phenotypic change in the size, taste, texture, or health of the apple."

The first step, translating English words into the letters of DNA, is easy, as long as one maintains a code. By analogy, Morse code does a similar thing with only two symbols, a dot and a dash. "*Malus ecclesia*" can, for example, be compressed using common English letter pairings and written in DNA as agtgtagcccaatcgcagaccctcaa.

Once they're coded, Church can assemble the letters into biologically viable, functional strands of DNA. In 2012, using the same process, he encoded and "printed" an entire book that he wrote on the topic, "Regenesis," into free-floating strands of DNA. Though state-of-the-art at the time, inserting the DNA into an organism is a different matter entirely. To get the DNA into the apple, Davis will use a type of bacteria

uniquely evolved to insert its genome through plant cell walls. Yoav Mayshar, a postdoctoral fellow at Harvard and the central geneticist on the project, told me that they can trick the bacteria into putting the DNA-encoded Wikipedia into apple saplings, which are then grafted onto apple stock and allowed to grow into adult trees. Because the changes to the fruit are biologically inert, the final apples will look like normal apples hanging from normal apple trees.

There is one hitch. The English version of Wikipedia contains two and a half billion words, but the bacterial genome has space for only so much information. DNA is a physical thing with a size and a weight, and, even using the cleverest compression, the bacterial DNA can only hold the equivalent of a few thousand words—about the size, coincidentally, of the Wikipedia entry on "good and evil." Davis explained that because all of Wikipedia will not fit into a single apple, bits and pieces of it will instead be spread across many apples and many trees. "I can fit the whole Wikipedia in a small forest, in—let's call it a very large grove," he explained. Because of the grafting process, each branch of each tree will contain apples with different pieces of Wikipedia, all of which together—given enough of them—will form the whole. The engineered apple, when

complete, will be twice forbidden—the Animal and Plant Health Inspection Service of the U.S. Department of Agriculture has strict rules against the unregulated eating of genetically altered plants.

To Davis, this tension is precisely the point. "It draws together science and religion in very close proximity," he said. Asked if he would take a bite, he pleaded the Fifth: "You know, I have tried to be very sincere and straightforward with every question you asked me, but, in this particular case, I'm going to claim artistic license."

Photograph by Artemis/Getty.

Patrick House is the author of "Nineteen Ways of Looking at Consciousness."

More: Elements object of interest techpages