certain that as knowledge rises in importance to the construction of a modern wealth pyramid, those that create big technological breakthroughs will be remembered as the empire builders of our current knowledge-based economy. They redefine humanity's future.

2 Lewis-Clark Dé Jàvu

On June 26, 2000, at a photo-opportunity ceremony at the White House attended by Craig Venter, President of Maryland-based Celera Genomics,[1] Francis Collins, director of the National Human Genome Research Institute, and the U.S. President William Jefferson Clinton, a historical moment was defined. As the doors to the ornate East Room of the White House slid open, President Clinton strode in flanked by Collins and Venter. "Today the world is joining us here in the East Room to behold a map of even greater importance," Clinton said, "Without a doubt, this is the most important, most wondrous map ever produced by humankind."

Figure 1. President Bill Clinton, flanked by Celera Genomics head Craig Venter (to his right) and Francis Collins, head of the Human Genome Project of the National Institutes of Health, meets reporters in the East Room of the White House. (Photo: Courtesy of Associated Press).

For people familiar with history and the White House, two centuries ago in 1806, President Thomas Jefferson had stood in the same room to view "a magnificent map" of North America produced by the Lewis-Clark expedition. The map Bill Clinton was referring to is the first draft of the human genome. Note the words used by Clinton, "of even greater significance", is there a deeper implication in the message? Was President Clinton trying to put his footprints in the sands of history by drawing the parallel between the human genome project and the Lewis-Clark expedition?[2] The Lewis-Clark expedition would later open up national trade in the U.S. The genetic map marks an epic and is expected to put the U.S. in a dominant position in the global trade of a different kind in a very different knowledge-based economy.

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[1] http://www.celera.com
[2] Irving W. Anderson, "A history of Lewis and Clark Expedition", http://www.lewisandclark.org/pages/story0.htm

Besides the uncannily identical "Jefferson" in the presidents' names, the ceremony leaves no doubt that it was set up to be a photo opportunity and the president was bathing in the glory of the accomplishment. It is ironic that the same technique used to sequence the human genome was also used in a 1999 DNA test to prove that President Thomas Jefferson could have fathered a child with a slave Sally Hemmings. And here we recall the outcome of the 1999 DNA fingerprinting of a stain on the famous Monica Lewinsky's blue dress, an evidence in the very politically motivated allegation of Bill Clinton's White House infidelity.

We believe the White House ceremony will be a footnote to this momentous event. Though President Clinton will be remembered for many other great achievements during his tenure, his name will likely be forgotten in this context. The same can be said of his counterpart, Prime Minister Tony Blair of United Kingdom, who held in tandem a ceremony in London to underscore the international nature of the genome project. But the wind of time will never erase the line etched into the sand of history by the completion of the first draft of the human genome.

3 The Human Genome Tour

The human body has 10 trillion cells. With the exception of red blood cells, each cell contains the entire human genome, all the genetic information needed to "build" a human being.

The entire human genome has 22 pairs of chromosomes (autosomes), and the X and the Y chromosome (sex chromosomes). A male has 22 pairs plus an X and a Y. A female has 22 pairs plus two X's. The 23 pairs of chromosomes that make up the human genome contain the complete information for human development. The chromosomes themselves are largely made up of very long DNA molecule, which has been elaborately wound up. The DNA, if stretched out, will be about 5 feet long and 50 trillionths of an inch wide. Somewhere hidden in the DNA coils and strung out in definite order are genes. The genes are simply sections of a chemical message which runs along the spine of the DNA molecule. Four chemical bases or nucleotides: Adenine (A), Guanine (G), Cytosine (C) and Thymine (T), run the full length of the DNA molecule. The order of these chemicals constitutes a code, instructing cells to make different proteins. The total information stored in the genome, therefore, can be most simply thought of as a very large encyclopedia containing the recipe for life. Despite the complexity of a human being, the recipe is written with an alphabet of only the four letters, A, C, G, and T. Using this analogy, *Encyclopedia Humanica* is three billion letters long from end to end. Somewhere in the encyclopedia are the clues to genetic diseases and phenotypes.

Pushing the encyclopedia analogy further, *Encyclopedia Humanica* contains all of the instructions needed to go from a fertilized egg to a complete human being. In this analogy, *Encyclopedia Humanica* has 22 volumes, and volume X and volume Y.