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The Genome Gets to Meet the Family

By NICHOLAS WADE

Long-winded, repetitious, immensely hard to understand, the human genome would not obviously qualify as the ideal weekend guest. But for anyone who has been putting off that inevitable one-to-one meeting, the American Museum of Natural History has prepared a most pleasant surprise in a new exhibition entitled "The Genomic Revolution." The show, which opens tomorrow, highlights the genome's elegance, power and decided air of mystery while playing down the awkward guest's most tiresome features.

The visitor's first sight of the genome is a giant gray column of DNA that stands in a farther room and is seen though a scrim. But then the eye is immediately caught by another aspect of the molecule of life, a gorgeous waterfall of color that cascades down a nearby wall. The image comes from a laboratory instrument known as a capillary sequencer, the chief workhorse of the two rival teams that decoded the human genome, the total genetic information of the species. The sequencer figures out the coded message in a DNA molecule by attaching different colored dyes to each of its four different bases. As the dyes stream out of hair-thin tubes, an electric eye records their passage and infers the order of the letters in the DNA molecule being analyzed.

With these two vivid images of DNA, one limned in ancient chiaroscuro and the other in the latest fluorescent DNA-analyzing dyes, the visitor then encounters a quite different representation, three stout columns of boxy-looking slabs, stacked in spirals that stretch from floor to ceiling. On closer inspection these turn out to be Manhattan phone directories, 142 of them, which contain the same number of printed letters — 3.2 billion — as there are chemical units in the DNA of the human genome. The display is intended to convey the enormous amount of information that is packed into the nucleus of an ordinary human cell, each of which contains two copies of the genome.

The exhibition thus gets off to a stunning start that simultaneously impresses the observer with the mystery, beauty and complexity of DNA. Next, before dipping into the scientific complexities of how DNA operates the organism, the designers draw attention to the possible impact of the new genomic knowledge with a wall of scrolling headlines predicting such possibilities as the conquest of disease and parental choice of children's attributes.

Some feared that Bill Gates would gain a monopoly of the personal computer with the Windows operating system, but Microsoft's power is minuscule compared with the absolute lock on biological programming enjoyed by evolution's software designer. All forms of life use the same programming language, and the instructions in that language, a k a genes, are very similar, even among species as far removed from each other as a man is from a mouse or a microbe. The reason, of course, is that many of the counterpart genes in each of these organisms have been inherited from an ancestral gene that existed in the earliest forms of life. The exhibition underlines this commonality of genes with a display panel in which the visitor can touch a photo of one species to learn how many of its genes are similar to human genes.

Next are tableaus about human genetics, one of which may explain why you never bothered to get in touch with your second cousin or learn about the lives of your great-great-grandparents. The reason is that they have only slightly fewer genetic differences with you than would someone plucked at random from a New York City street.

The exhibition now gently offers the chance to learn more about how DNA programs the operation of a living cell. It takes the example of color blindness, which can be caused by defects in the genes for one of the opsin proteins. Seven wall panels and a film loop in an adjacent theater offer much detailed information for those who are interested. This is the hard science part of the exhibition, and in a clear and enticing way it does a fine job of presenting as much detail as a general audience can probably stomach.

The visitor is then led into a section where wall panels discuss some of the social consequences of the new genetic knowledge, grouped under

Microarrays monitor the activity of thousands of genes at a time. One of their most useful tricks is to compare a normal cell with a cancerous cell so as to determine which genes are wrongly switched on (or off) in the cancer cell. The devices are marvels of miniaturization, being based on a little window of glass an inch or less on each side. The exhibition designers have turned a DNA microarray into a glorious macroarray, a giant box gridded with lights of different hues and intensities. The display gives viewers a good feel for the complexity of human cells and the daunting task biologists face in trying to figure out the meaning in the complex pattern of genetic activity the microarrays measure.

The centerpiece of the next room is a beautiful assembly of exotic plants and creatures whose common theme is that museum scientists have learned interesting things from their DNA. Perhaps some extra visual reminder would have helped here to underline for the spectator that each of these creatures, from the northern elephant seal to the monarch butterfly, is made of cells that run on the same operating system. Beneath the riotous diversity of nature lies the unity of DNA's ubiquitous programming language.

To the side is a DNA lab where visitors can scrape a few cells from the inside of the cheek and extract their own DNA. There are also thoughtful discussions with visually arresting displays about genetically modified foods and the art of cloning.

For a finale, there is a striking piece of participatory computer art created by Camille Utterback. It is a camera that projects a digitized image of the viewer. But the pixels on the screen are just A's, T's, G's or C's, the four letters of the DNA alphabet, prompting visitors to wonder whether they are just a program based on their own DNA or perhaps something more, but if so what?

This bare description does insufficient justice to the appearance of the exhibition, which was organized by Rob DeSalle and designed by the museum's in-house team. Every object is elegant and interesting and draws in the eye, if not the hand as well. Visitors shouldn't hesitate to scoop up the little vial of DNA they will see on entering the exhibition — real as it seems, it's just an image projected by a clever lensing technique.

The show, in its preview stage, included an oversight of a certain physical consequence: there should have been 284 Manhattan phone books to indicate the information storage capacity of an ordinary human cell's nucleus, not the 142 displayed, since ordinary cells contain two copies of the genome, one from each parent. A museum spokesman said that the glitch would be corrected, either by changing the text or ordering another 142 phone directories.

The contents of the show strike a judicious balance between the science of the genome and its applications. People find it easier to discuss the possible hazards of genetic testing and modified crops than the complicated mechanics that lie between a sequence of DNA bases and a physical trait in an organism. The designers have tried to make the exhibition work on both levels and to a large extent have succeeded.

According to Ellen V. Futter, the museum's president, this is the first exhibition to describe the emerging genome revolution to the public. It is a brave and excellent start and sets a high standard for the many that will doubtless follow. It may even make you think you'd like to get to know the genome a little better.