

Session 3 Focus on Science Genetics



A VIEWING AND DISCUSSION
PROGRAM IN
AMERICA'S LIBRARIES

The twisted ladder of DNA, from which genes are constructed, performs two fundamental functions in life. It is the means by which inherited traits are passed from one generation to the next, and it provides instructions within cells for expressing those traits. Remarkably, DNA has only four distinct molecules constituting the rungs of the ladder: adenine, thymine, guanine, and cytosine. (The rails up the outside of the ladder are mostly sugar.) Moreover, those four nitrogen bases can only pair up one way: adenine with thymine (A-T or T-A) and guanine with cytosine (G-C or C-G). Those two pairs, backward and forward and repeated billions of times, are somehow responsible for the incredible diversity of life.

The key, of course, is "billions of times." Human DNA contains about three billion base pairs, give or take a hundred million. That's one billion three-letter "words" (codons) of instruction for creating proteins and doing the other work that moves life along. Interestingly, an organism's complexity does not correlate simply to its genetic endowment. Some salamanders, for example, have as much as ten times more DNA-which is not to say genes-than humans; and a small plant (*A. thaliana*), whose DNA possesses only some 125 million base pairs (4% of the human number), has about 84% as many genes as a human.

The basic notion behind the processes ruled by DNA is this: The rungs of the ladder split down the middle, leaving two half-ladders. For replicating genetic information (reproduction), chemicals in the cellular environment-enzymes-move in and pair up each set of half-rungs with their complementary bases. Since the pairs must be A-T or G-C, the result is two ladders identical to the original, a fairly straightforward procedure.

For getting information from DNA out into the organism, different compounds match up to the split ladder and then move off, encoded to create proteins or start other processes. And so it might seem straightforward to trace the processes back and find genes for this or that characteristic. If only it were that simple! As researchers probe with more finely honed chemical, physical, and biological tools, it becomes clear that life is as complex at the molecular level as it is everywhere else. Singly and in combination, proteins, RNA, and perhaps even sugars play determining roles in the expression of an organism's genetic inheritance; finding that gene for staying up late and getting up early may be no more than a dream.

DNA from the Beginning

<http://www.dnafb.org/dnafb/>

A thorough exploration and explanation of DNA