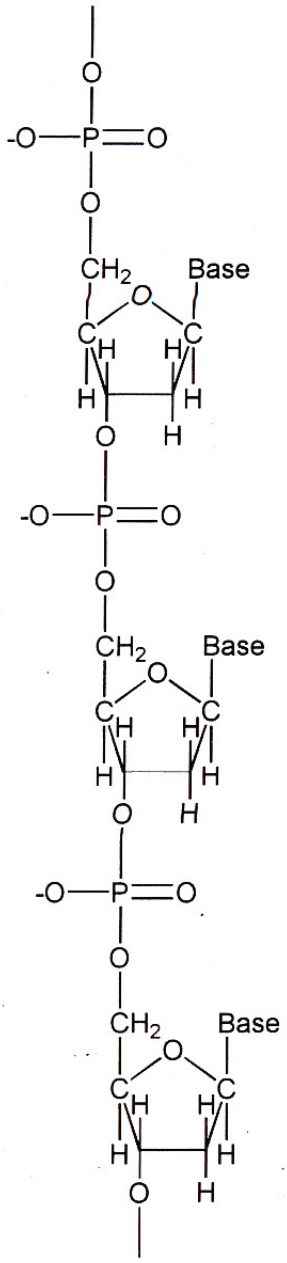
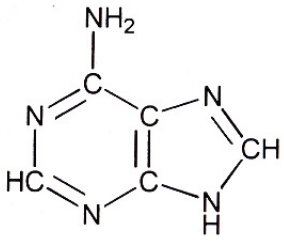
## 18: *The Molecules of Life—Nucleic Acids*

A fascinating and rapidly growing area of science is the chemistry of living things called **biochemistry** ("life" + "chemistry"). Compared to the simple chemistry we have studied to this point, biochemistry is complex because the molecules of living things tend to be extremely large and complex. The chemistry of living things is unique. While chemicals seem to be just lying out there in great chemical deposits in the earth, having no particular function of their own, molecules in living systems have a specific function—a specific *reason* for existing, if you will.

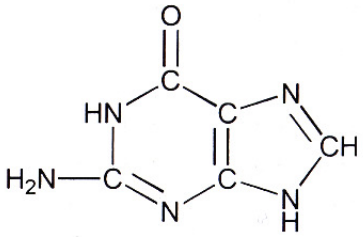
These so-called **biomolecules** generally fall into one of a few classes. First, **nucleic** [noo-KLĒ-ik] **acids** are the information carriers of



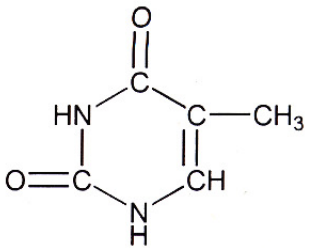

Adenine



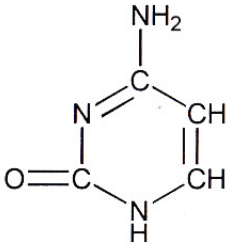

Guanine




Thymine




Cytosine




*On the left is the nucleic acid backbone made of deoxyribose sugars linked together with phosphate ($PO_4$) groups. Everywhere the word "base" appears on the molecule, one of the four nucleotide bases (shown on the right) is substituted. The sequence of nucleotide bases forms the genetic code that directs all of the cell's activities.*

living things. They are made of a sequence of smaller molecules linked together to form a long chain. This sequence carries information in the form of a code that the body can decode and use.

There are two major types of nucleic acids. **Deoxyribose** [dē-OX-ē-RĪ-bōs] **nucleic acid (DNA)** carries a code which specifies every physical aspect of a living thing, including a range of heights and weights, eye, hair and skin color, and approximate length of life. We call this the **genetic code**. Not only humans, but all animals, plants, and even bacteria have their own codes which specify their every characteristic passed to them from their parents.

The Diagram on the previous page shows the structure of a short piece of a DNA chain made of deoxyribose sugar molecules linked together by phosphate ($PO_4$) groups. Where the word "Base" is seen on the main chain, one of the four **bases** ("fundamental molecules") on the right-hand side of the Diagram would be found. It is the exact order of those bases on the chain which makes up the code. Bases attract other bases, so two strands of DNA attract each other. When they do, the bases pair off into **base pairs**. In base pairs, adenine is always attracted to thymine, and cytosine is always attracted to guanine, so you can be sure that if you know the sequence of bases on one strand of DNA, you can figure out the sequence of bases on its partner. Everywhere there is an adenine molecule on one strand, you will find a thymine molecule on its partner, and so on.

Scientists are now not only coming to a greater understanding of this chemistry, but are beginning to learn to modify the genetic code to some extent as well. Using a combination of chemistry and biology called **molecular biology**, they have begun to treat and to prevent certain diseases carried in this code. The discipline of molecular biology is also referred to as "**genetic engineering**."

The second type of nucleic acid is **ribose nucleic acid** (RNA). RNA is used by living things to copy the DNA code and translate it for the building of the tiny machines that carry out all of the body functions. We will learn more about these little machines, called **proteins**, in the next lesson. In future lessons, we will also learn more about the importance of nucleic acid molecules to life, as we learn exactly what functions they perform within living things.