RNA: Ribonucleic Acid

RNA molecules are responsible for the synthesis of proteins, which in turn control the operation and function of the cell. RNA differs from DNA in four basic ways: (1) the sugar unit in the backbone of RNA is ribose rather than deoxyribose, (2) RNA contains the base uracil, U, instead of thymine, which occurs in DNA, (3) RNA is a single-stranded molecule rather than a double-stranded helix like DNA, and (4) RNA molecules typically consist of 75 to a few thousand nucleotide units rather than the millions that exist in DNA. Even though RNA is much smaller than DNA, RNA is still large enough to twist, coil, bend, and fold back onto itself. In fact, it is not uncommon for up to 50% of an RNA molecule to have a double-helix structure. The reason is that the base sequences along the helical regions of the RNA strand are complementary, which makes hydrogen bonding between bases possible.

Synthesis of RNA

RNA is synthesized in the nucleus of eukaryotic cells, where DNA and protein molecules actually help synthesize specific RNA molecules. RNA can also be seen by STM, as shown in **Figure 24.** As RNA is synthesized, some information contained in the DNA is transferred to the RNA molecules. Like the genetic information of DNA, the genetic information of RNA is carried in its nucleotide sequence. One type of RNA molecule is called *messenger RNA* (mRNA) because it carries the instructions for making proteins out into the cytosol, where proteins are produced on *ribosomes. A* **ribosome** *is a cell organelle that is composed of RNA and protein. Ribosomes are the main site of protein production in cells.* The DNA template is also used to make two other types of RNA molecules: *ribosomal RNA* (rRNA) and *transfer RNA* (tRNA). Both of these types of RNA also leave the nucleus and come together in the ribosome where they help synthesize proteins. Ribosomal RNA becomes part of the structure of the ribosome, and tRNA is used to transfer amino acids into the ribosome. Only mRNA carries the coded genetic information that is translated into proteins.

DNA supplies all of the information necessary for RNA to be used to make the proteins needed by the body. The portion of DNA that holds the specific genetic code for a single, specific mRNA molecule is a gene. As you learned previously, each gene is a section of the DNA chain that contains a specific sequence of the bases A, G, T, and C. A gene has the information necessary in this sequence to direct RNA to produce several proteins that have specific functions.

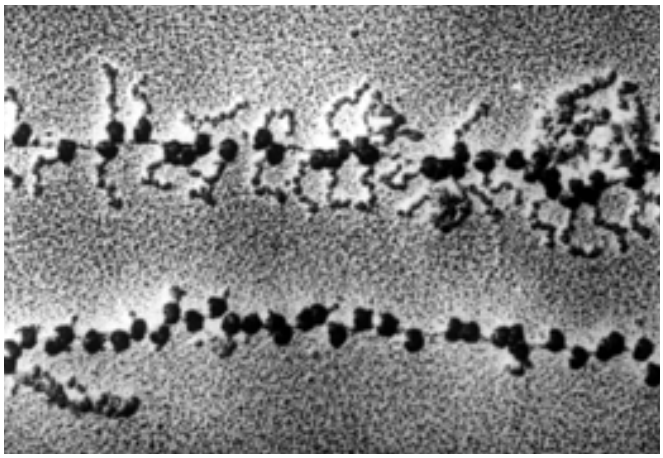

FIGURE 24 Scanning tunneling micrograph of RNA strands being transcribed in a cell.