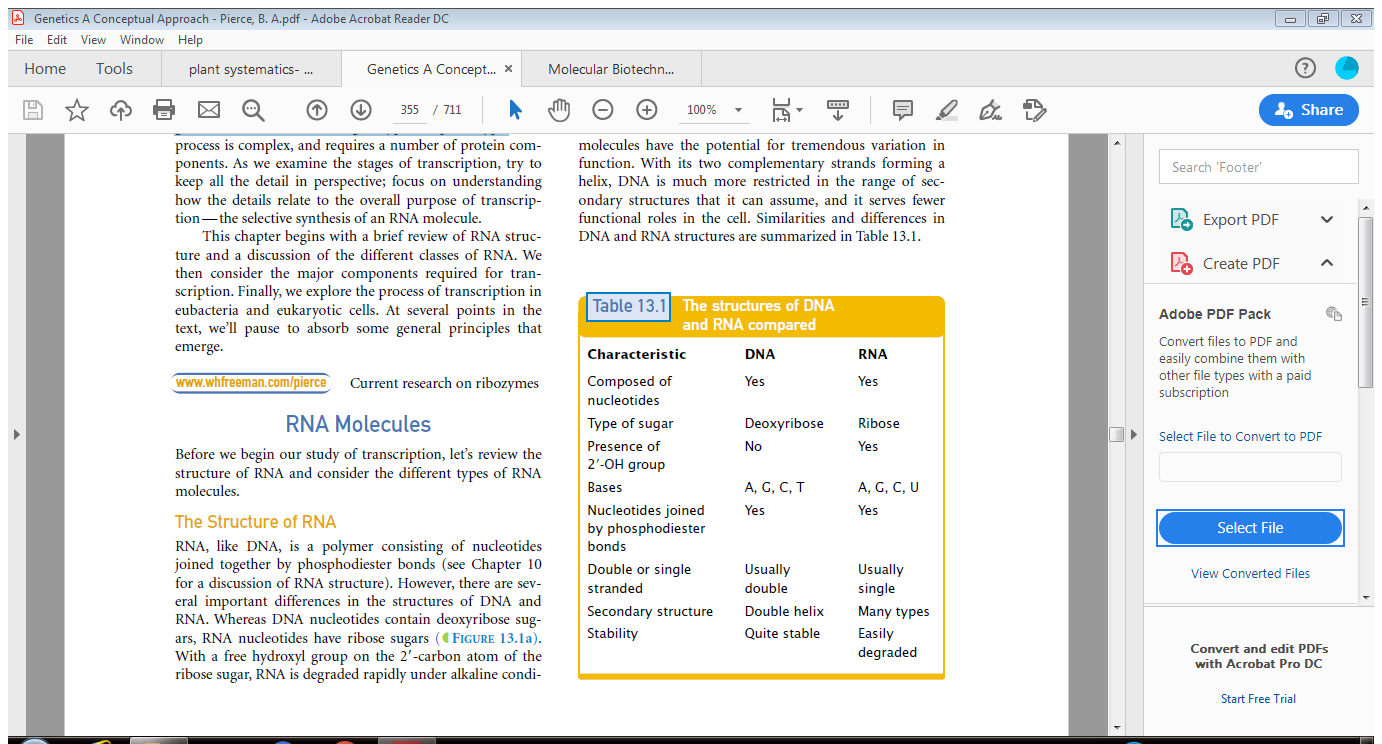
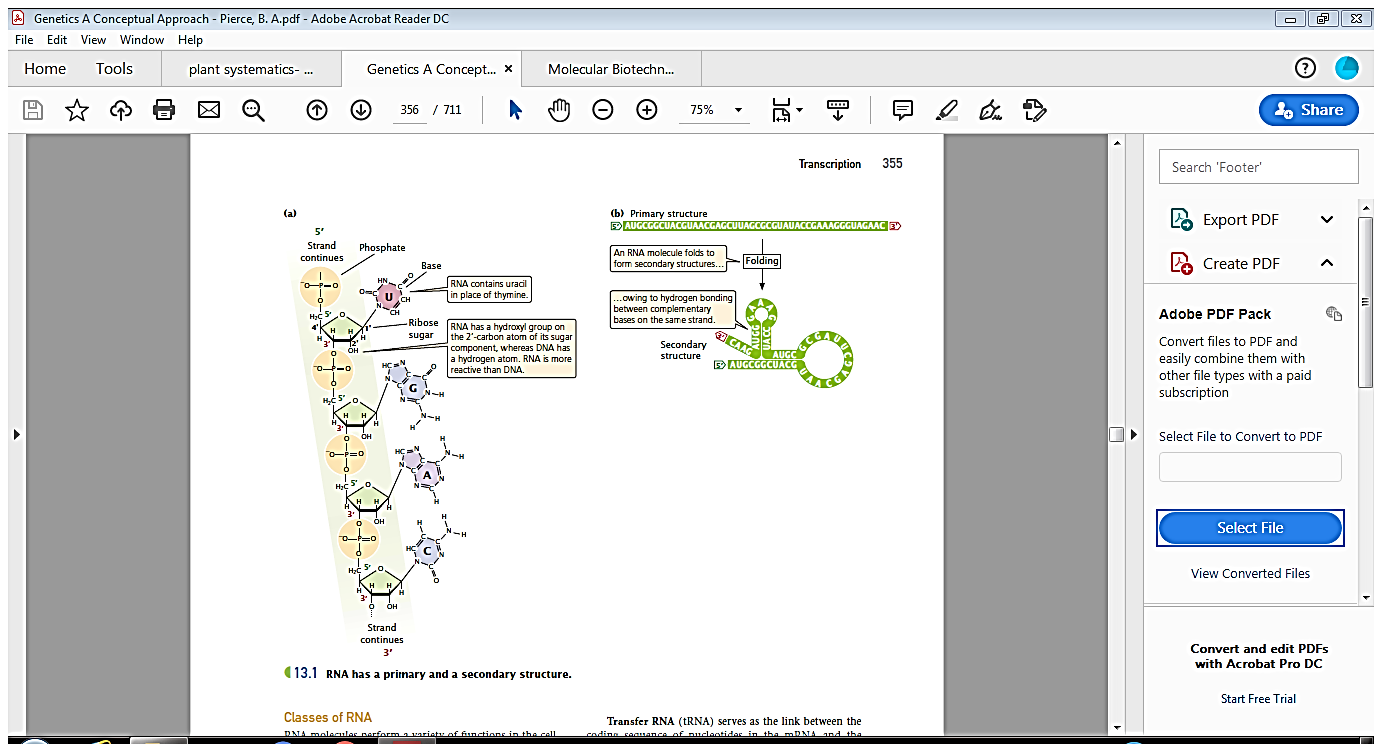
**TRANSCRIPTION**

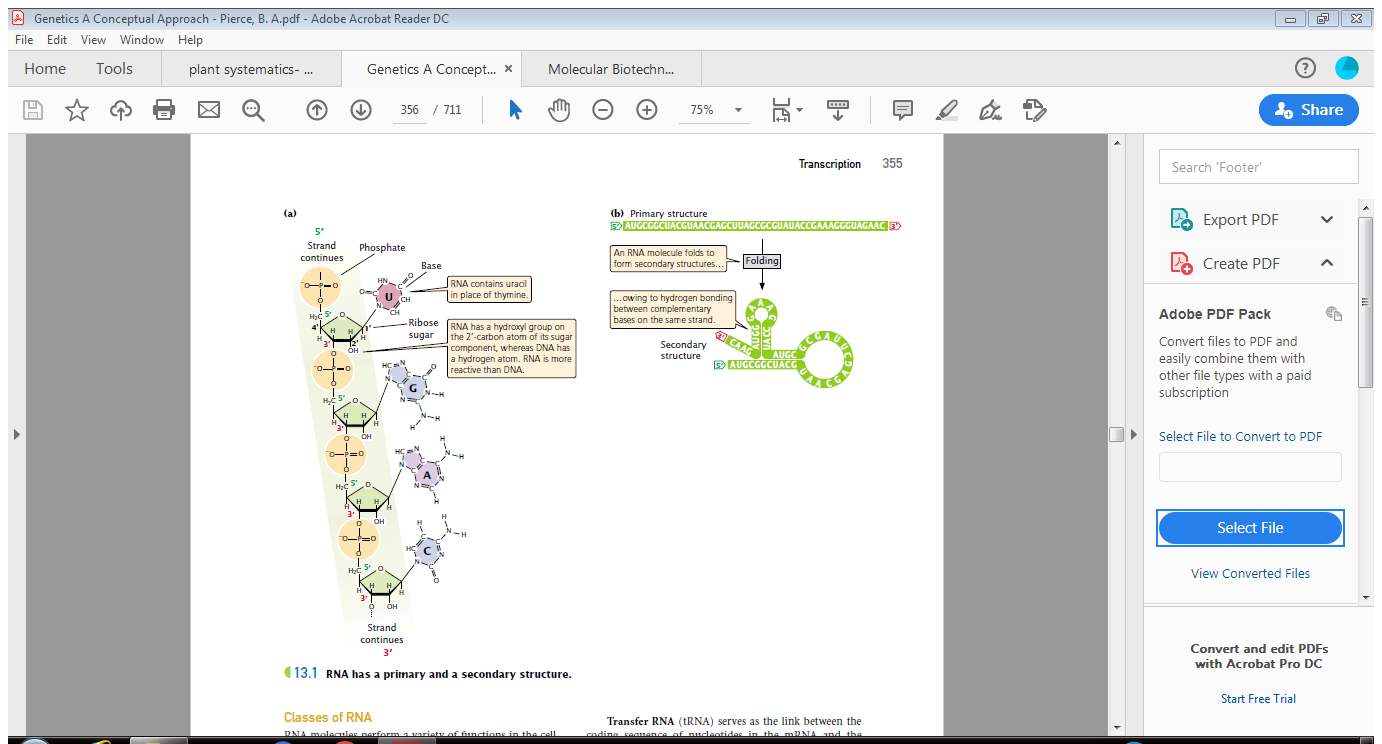
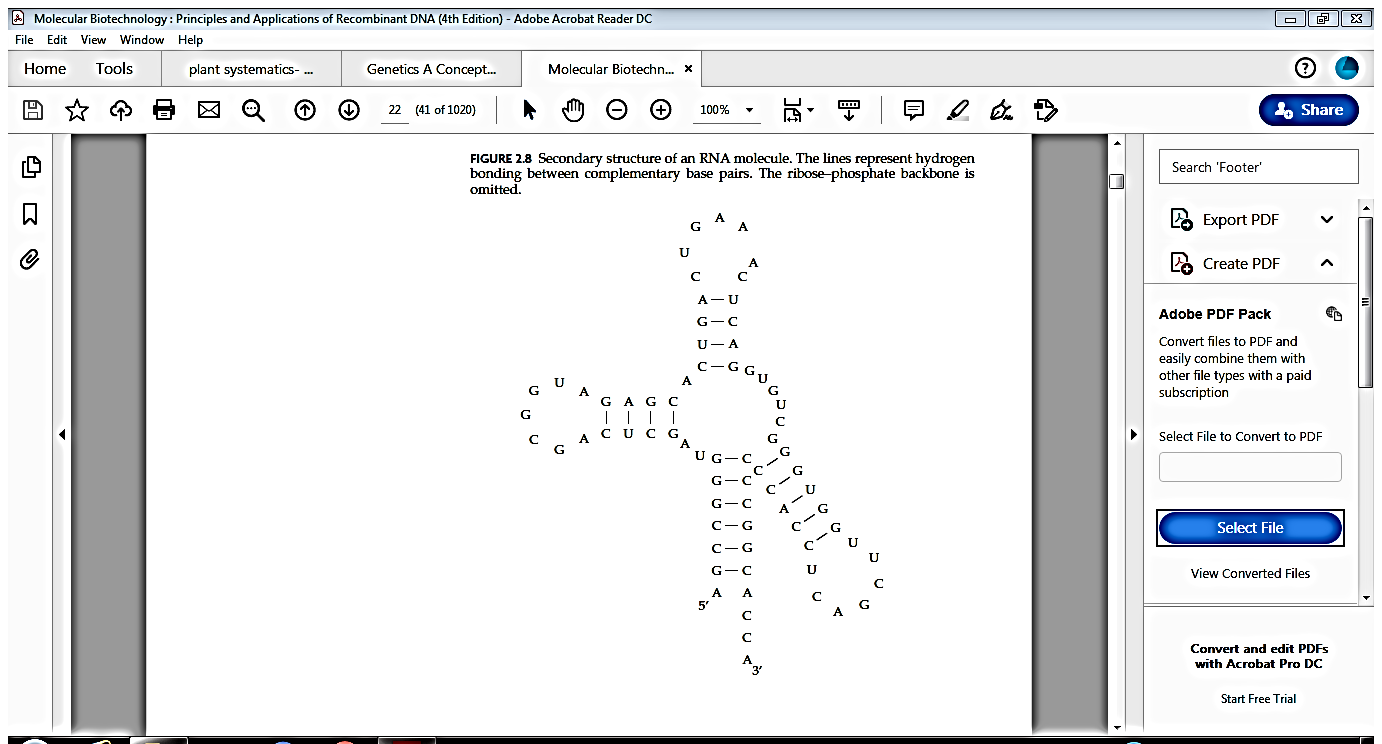
Transcription is the synthesis of RNA molecules, with DNA as a template, and it is the first step in the transfer of genetic information from genotype to phenotype. Genes encode information for production of proteins. The decoding of genetic information is carried out through intermediary RNA molecules that are transcribed from discrete regions of the DNA.

RNA

RNA molecules are linear polynucleotide chains that differ from DNA in two important respects. First, the sugar moiety of the nucleotides of RNA is ribose, which has hydroxyl groups on both the 2’ and 3’ carbons of the sugar. Second, instead of thymine, the base uracil (U) is found in RNA. Most RNA molecules are single stranded, although often there are segments of nucleotides within a single chain that are complementary to each other and form double-stranded regions. RNA has single polynucleotide strand whereas DNA has double polynucleotide strands.

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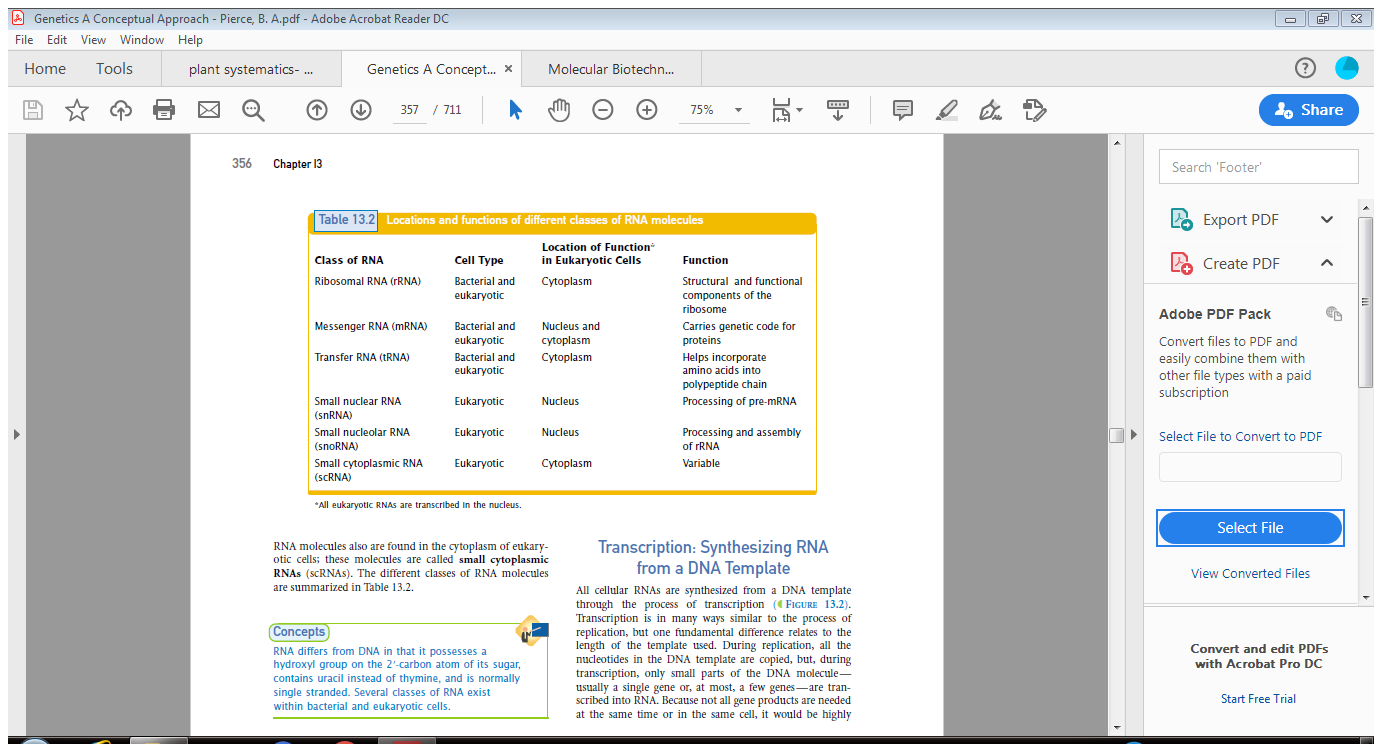
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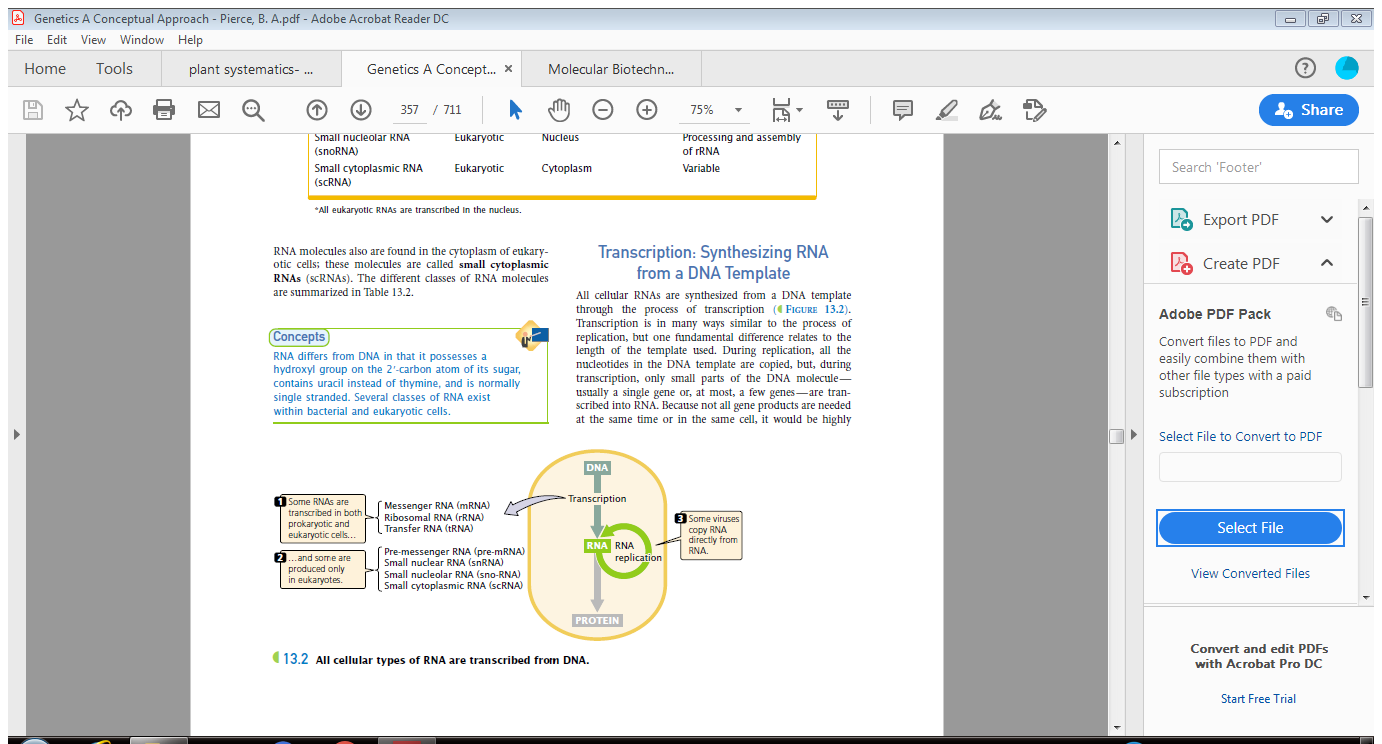
**Secondary structure formed by single stranded RNA based on complementary region**

**Classes of RNA-** There are various types of RNA in a cell each performing different function. Summary of the location and function of RNA is given in the table below. Ribosomal RNA (rRNA), along with ribosomal protein subunits, makes up the ribosome, the site of protein assembly.

**Messenger RNA** (mRNA) carries the coding instructions for polypeptide chains from DNA to the ribosome.

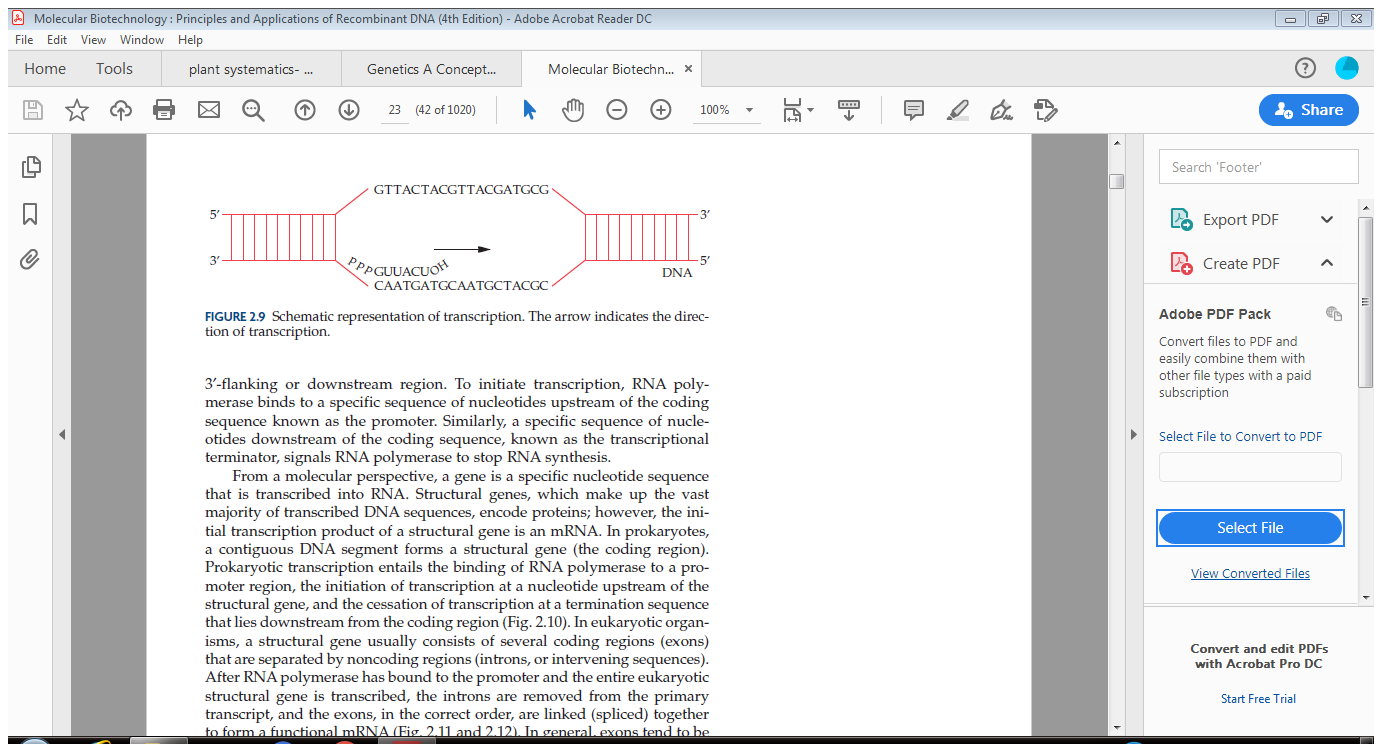
**Transfer RNA** (tRNA) serves as the link between the coding sequence of nucleotides in the mRNA and the amino acid sequence of a polypeptide chain. Each tRNA attaches to one particular type of amino acid and helps to incorporate that amino acid into a polypeptide chain. **Small nuclear RNAs** (snRNAs) combine with small nuclear protein subunits to form **small nuclear ribonucleoproteins** (snRNPs, affectionately known as “snurps”). They help in RNA splicing during RNA processing in Eukaryotes. **Small nucleolar RNAs** (snoRNAs) take part in the processing of rRNA. RNA molecules also are found in the cytoplasm of eukaryotic cells; these molecules are called **small cytoplasmic RNAs** (scRNAs).

All Types of RNA are transcribed from DNA. Some are transcribed in both Prokaryotes and Eukaryotes, some are transcribed only in Eularyotes.

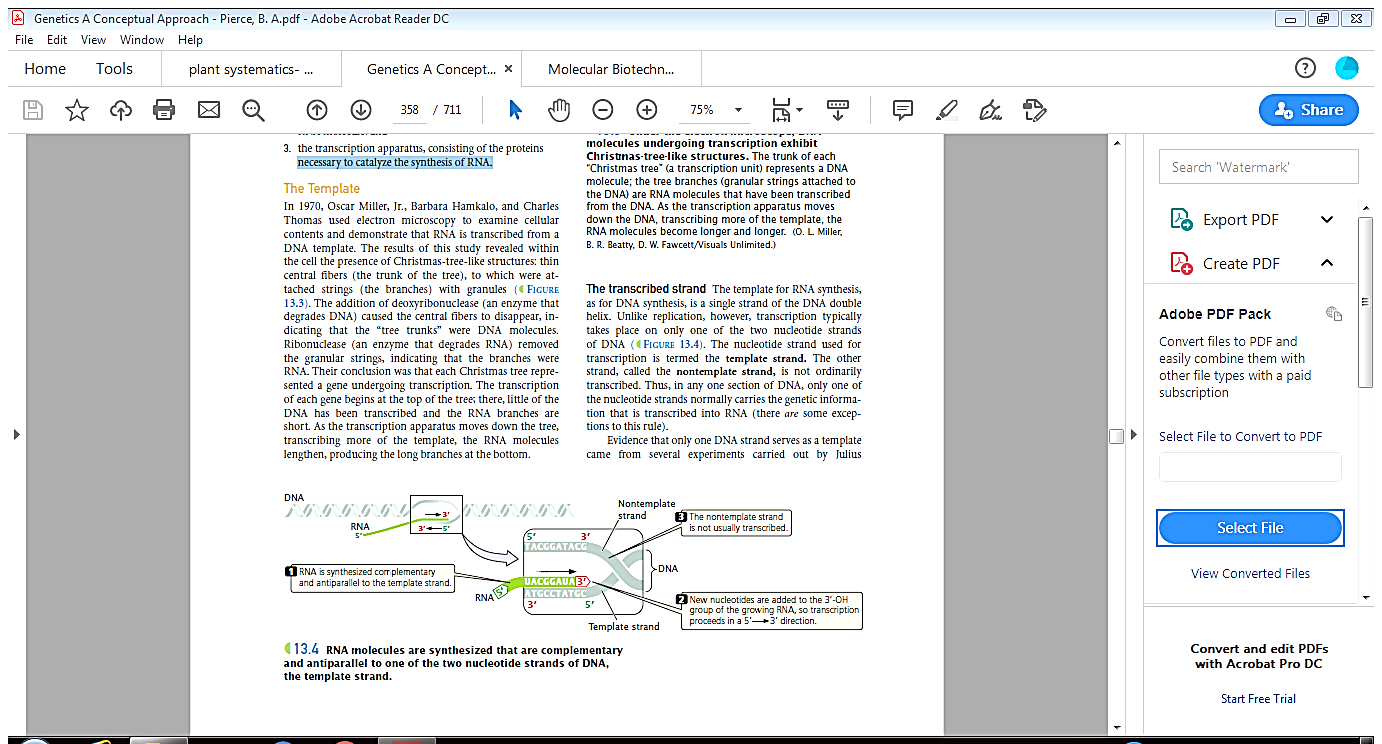


Transcription is the process of synthesis of RNA from DNA. Thus this process requires

* The template DNA, the raw materials (substrates) needed to build a new RNA molecule; and, the transcription apparatus, consisting of the proteins necessary to catalyze the synthesis of RNA .



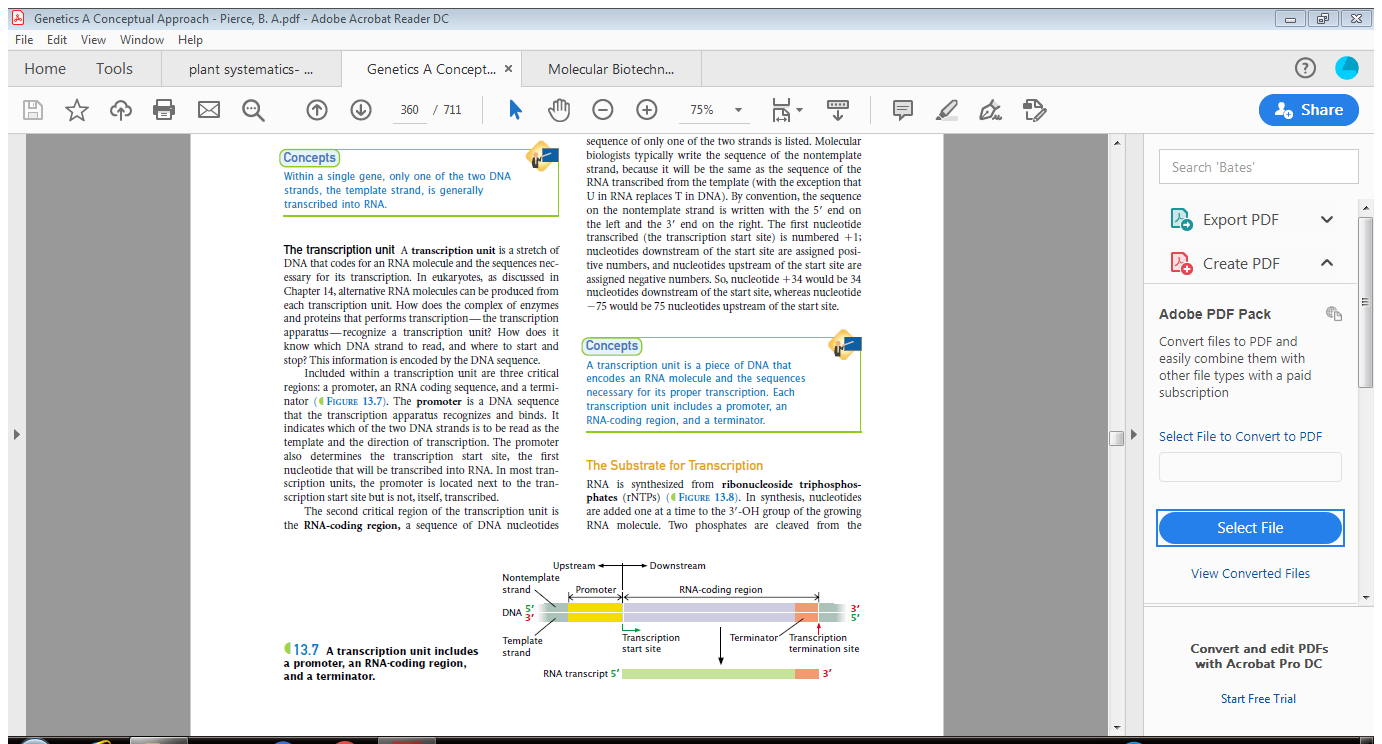
The template Strand- Out of the two strands, one act as template for RNA synthesis. i.e. transcription takes place in only one of the strand. The nucleotide strand used for transcription is termed the template strand. The other strand, called the non - template strand, is not ordinarily transcribed. mRNA shows sequence similarity with non template strand, since it has codon for protein so non template strand is also called coding strand or sense strand. Similarly template strand is called Non coding or Anti sense strand.



The Transcriptional Unit

A transcription unit is a piece of DNA that encodes an RNA molecule and the sequences necessary for its proper transcription. Each transcription unit includes a promoter, an RNA-coding region, and a terminator.

The **promoter** is a DNA sequence that the transcription apparatus recognizes and binds. It indicates which of the two DNA strands is to be read as the template and the direction of transcription. The promoter also determines the transcription start site, the first nucleotide that will be transcribed into RNA. **The RNA-coding region**, is a sequence of DNA nucleotides that is copied into an RNA molecule**.**

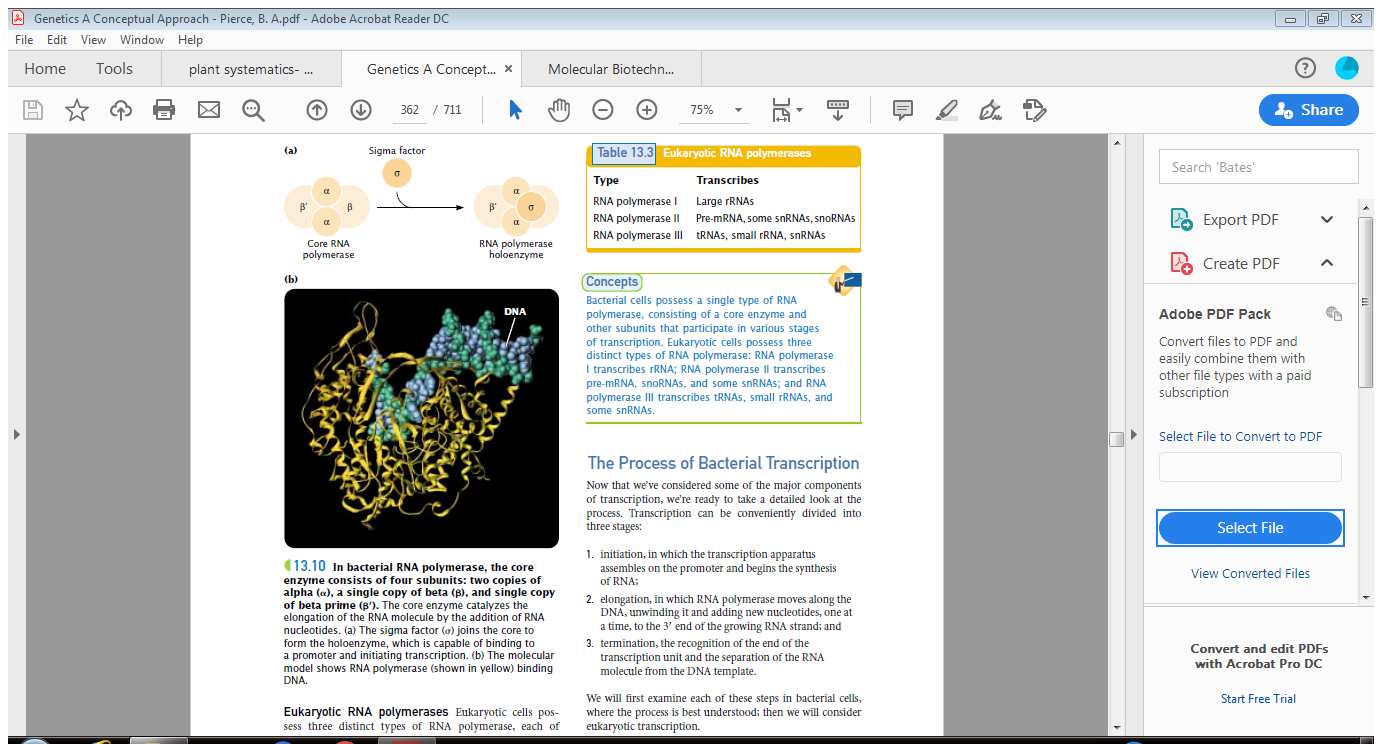
**The terminator**, a sequence of nucleotides that signals where transcription is to end. Terminators are usually part of the coding sequence; that is, transcription stops only after the terminator has been copied into RNA.

Region of DNA which left to the transcripyion start site is called Upstream region and which is right to transcription start site is called downstream region. Transcription apparatus moves downwards to trancscription start site.

**The Transcription Apparatus –** It is basically RNA polymerase with additional accessory proteins and factors involved in transcription. Each accessory protein is responsible for providing or regulating a special function.

**factor.**

**Bacterial RNA polymerase-** Bacterial RNA polymerase is a large, multimeric enzyme. It is made up of core enzymes and  sigma ) . The core enzyme hastwo copies of a subunit called alpha , a single copy of beta (), and single copy of beta prime (’)



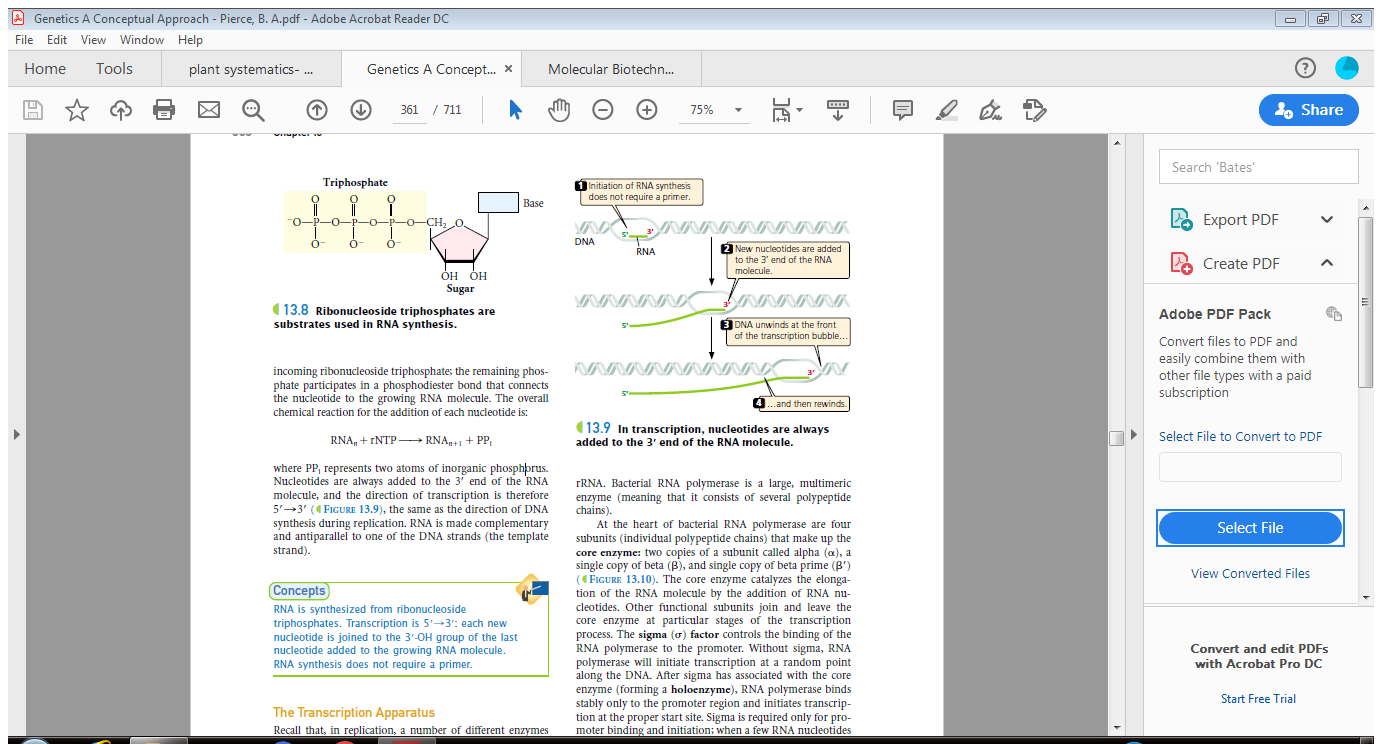
**Eukaryotic RNA polymerases** -Eukaryotic cells possess three distinct types of RNA polymerase, each of which is responsible for transcribing a different class of RNA: **RNA polymerase I** transcribes rRNA; **RNA polymerase II** transcribes pre-mRNAs, snoRNAs, and some snRNAs; and **RNA polymerase III** transcribes small RNA molecules—specifically tRNAs, small rRNA, and some

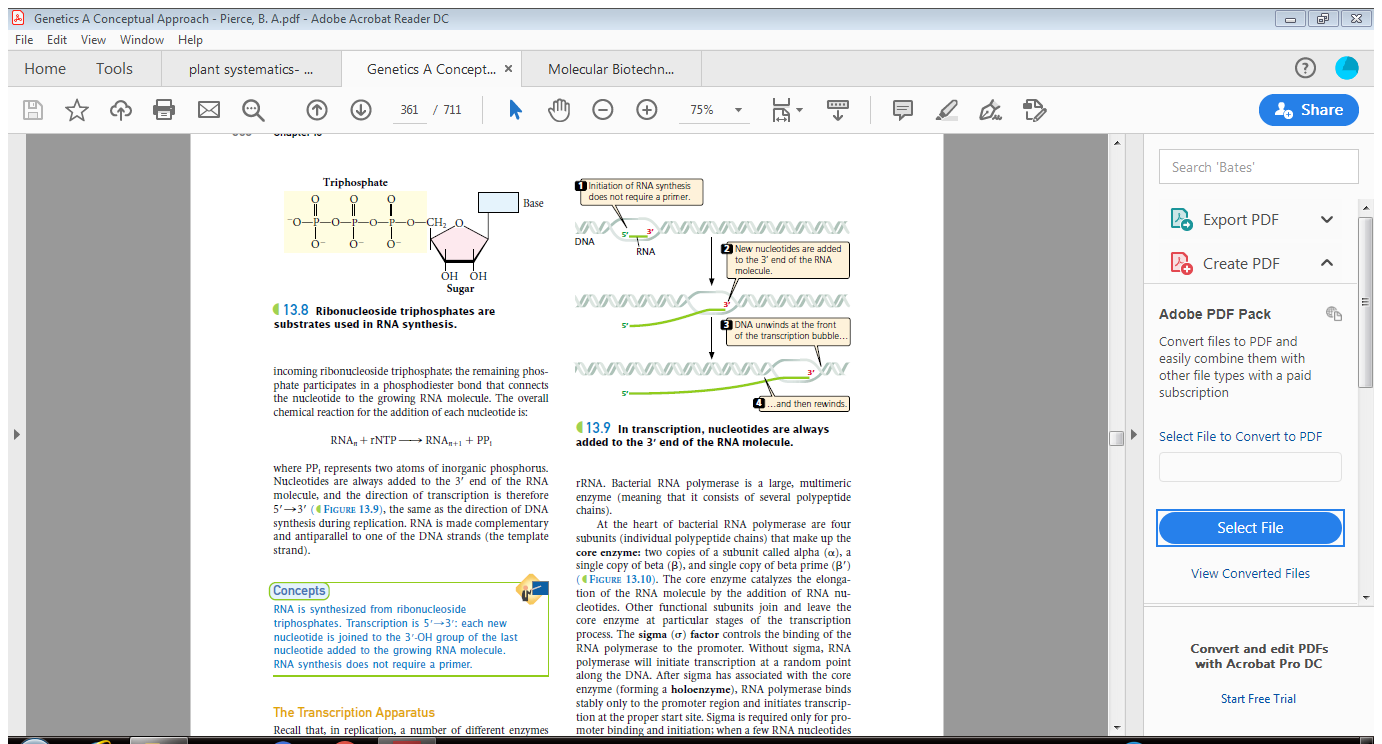
snRNAs . All three eukaryotic polymerases are large, multimeric enzymes, typically consisting of more than a dozen subunits.

**Substrate for transcription**

**R**NA is synthesized from ribonucleoside triphosphosphates (rNTPs)

The over all reaction can be written as





where PPi represents two atoms of inorganic phosphorus. Nucleotides are always added to the 3 end of the RNA molecule, and the direction of transcription is therefore 5’-3’.

RNA synthesis does not require a primer