rRNA

Ribosomal RNA is a component of the ribosomes, the protein synthesis factories in the cell. Eukaryotic ribosomes contain four different rRNA molecules: 18S, 5.8S, 28S, and 5S rRNA (16S rRNA, 5S rRNA and 23S rRNA in prokaryotes). rRNA molecules are the most abundant form of RNA in the cell. They make up at least 80% of the RNA molecules found in a typical eukaryotic cell.

Synthesis of the three nucleolar rRNA molecules is unusual because they are made on one primary transcript that is chopped up into three mature rRNA molecules. These rRNA molecules and the 5S rRNA combine with the ribosomal proteins in the nucleolus to form pre 40S and pre 60S ribosomal subunits. These pre-subunits are exported to the nucleus where they mature and assume their role in protein synthesis.

The rRNA molecules have several roles in protein synthesis. First, the 28S and 23S rRNA have a catalytic role, it forms part of the *peptidyl transferase activity* of the 60S and 50S subunit in eukaryotes and prokaryotes, respectively. Second, 18S and 16S rRNA has a recognition role, involved in correct positioning of the mRNA and the peptidyl tRNA.

snRNA

snRNA (small nuclear RNA) is a class of small RNA molecules that in found within the nucleus of eukaryotic cells. They are involved in a variety of important processes such as RNA splicing (removal of introns from

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hnRNA) and maintaining the telomeres. They are always associated with specific proteins, and the complexes are referred to as *small nuclear ribonucleoproteins* (snRNP) or sometimes as snurps.

snoRNA

snoRNA (small nucleolar RNA) is a class of small RNA molecules that are involved in chemical modifications such as methylation of rRNAs and other forms of RNA in eukaryotes. snoRNAs are a component in the small nucleolar ribonucleoprotein (snoRNP), which contains snoRNA and proteins. The snoRNA guides the snoRNP complex to the modification site of the target RNA gene via sequences in the snoRNA that hybridize to the target site. The proteins then catalyze modification of the RNA gene.

gRNAs

gRNAs (guide RNA) are RNA genes that function in RNA editing. RNA editing was first reported in the mitochondria of *kinetoplastids*, in which mRNAs are edited by inserting or deleting stretches of *uridylates* (Us). The gRNA forms part of the **editosome** and contains sequences that hybridize to matching sequences in the mRNA, to guide the mRNA modifications.

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Small silencing RNAs

Small silencing RNAs are small RNA of ~20–30 nucleotides long and make an association with members of the *Argonaute* protein family, which they guide to their regulatory targets. After the discovery of the first small silencing RNA in year 1993, several small RNA classes have been identified which differ in their biogenesis, their modes of target regulation and in the biological pathways they regulate. Most common examples of these small RNAs are siRNA (small interfering RNA), miRNA (micro RNA) and piRNA (Piwi-interacting RNA).

miRNAs are endogenous regulatory RNAs which are typically 20–25 nucleotides long, and are thought to regulate the expression of other genes. miRNAs derive from precursor transcripts called *primary miRNAs* (pri-miRNAs), which are typically transcribed by RNA polymerase II. The pri-miRNA is processed in the nucleus into a 60-70 nucleotide pre-miRNA by the activity of *Drosha*, a nuclear enzyme. The pre-miRNA molecule is then actively transported out of the nucleus into the cytoplasm by *exportin* protein. The *Dicer* enzyme, a dsRNA specific RNaseIII family endonuclease, then cuts pre-miRNA into the mature miRNA.

siRNAs are small RNA molecules of 21–25 nucleotides. siRNA duplexes produced by the Dicer. Out of two strands the one that directs silencing of target mRNA is called *guide* RNA. Whereas the other strand which is ultimately destroyed, is the *passenger* strand. Target regulation is mediated by RISC (RNA Induced Silencing Complex). siRNA may be exo-siRNA and endo siRNA depending on the source of RNA.

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tmRNA

tmRNA has a complex structure with tRNA-like and mRNA-like regions. It has currently only been found in bactena. tmRNA recognizes ribosomes that have trouble translating or reading an mRNA and stall, leaving an unfinished protein that may be detrimental to the cell. tmRNA acts like a tRNA first, and then an mRNA that encodes a peptide tag. The ribosome translates this mRNA region of tmRNA and attaches the encoded peptide tag to the C-terminus of the unfinished protein. This attached tag targets the protein for destruction or proteolysis.

Alkali-catalyzed cleavage of RNA

Under alkaline conditions, RNA is hydrolyzed rapidly and generates a mixture of 2'- and 3' nucleoside monophosphate. In the presence of a hydroxide ion, the 2'-hydroxyl group of the ribose is converted to a 2'-alkoxide ion. The 2'-alkoxide attacks the 3'-phosphodiester group, breaking the 5'-3' phosphodiester bond and forming a cyclic 2',3'-nucleoside monophosphate. Another hydroxide ion attacks the cyclic 2',3'-nucleoside monophosphate, yielding a mixture of 2'-and 3'-nucleoside monophosphates. DNA is stable in basic solution because DNA lacks a 2'-hydroxyl group to carry out intramolecule catalysis.

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