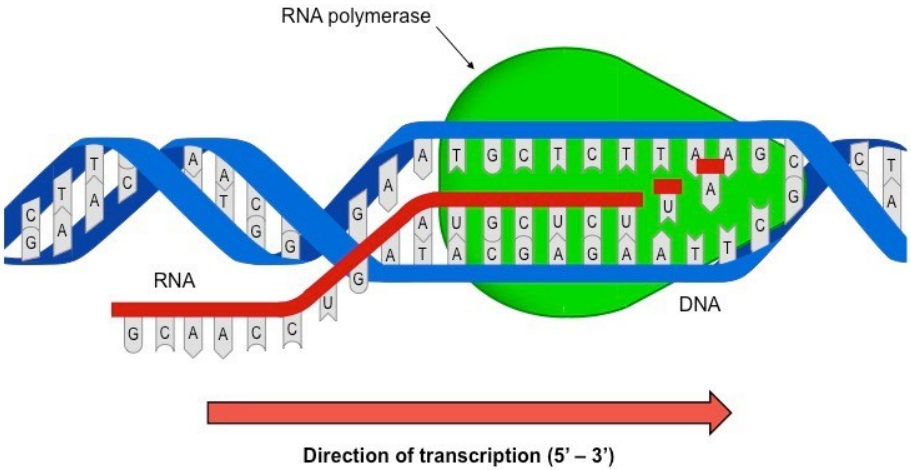
The biochemical machinery in the cytoplasm of each cell has the capacity to make every protein from just 20 amino acids. Exactly which proteins it manufactures depends upon the instructions that are provided by the DNA in the cells nucleus. The basic process is:

- **DNA provides the instructions in the form of a long sequence of bases.**
- **A complementary section of part of this sequence is made in the form of a molecule called pre-mRNA (a process called transcription)**
- **The pre-mRNA is spliced to form mRNA**
- **The mRNA is used as a template to which complementary tRNA molecules attach and the amino acids they carry are linked to form a polypeptide (process called translation).**

The process can be likened to a bakery:

The basic equipment and ovens (**cell organelles**) can manufacture any variety of cake (**protein**) from relatively few basic ingredients (**amino acids**). Which variety of cake is made depends on the recipe (**genetic code**) that the baker uses on any particular day. **By choosing different recipes at different times, rather than making everything all the time, the baker can meet seasonal demands, adapt to changing customer needs and avoid waste.**



Polypeptide synthesis: transcription and splicing

Transcription: the process of making pre-mRNA using part of the DNA as a template.

1. **an enzyme acts on a specific region of the DNA causing the two strands to separate and expose the nucleotide bases in that region.**
2. The **nucleotide bases on one of the two DNA strands, known as the template strand, pair with their complementary nucleotides** from the pool which is present in the nucleus. The **enzyme RNA polymerase then moves along the strand and joins the nucleotides together to form a pre-mRNA molecule.**
3. In this way, **an exposed guanine base on the DNA binds with the cytosine base of a free nucleotide** and so on.
4. **As the RNA polymerase adds the nucleotides one at a time to build a strand of pre-mRNA, the DNA strands rejoin behind it.** As a result, only about 12 base pairs on the DNA are exposed at any one time.
5. **When the RNA polymerase reaches a particular sequence of bases on the DNA that it recognises as a 'stop' triplet code, it detaches, and the production of the pre-mRNA is then complete.**

Splicing of pre-mRNA:

The DNA of a gene in eukaryotic cells is made up of sections called exons that code for proteins and sections called introns that do not.

These intervening introns would prevent the synthesis of a polypeptide in the pre-mRNA of eukaryotic cells. **The base sequences corresponding to the introns are removed and the functional exons are joined together during splicing. As most prokaryotic cells do not have introns splicing their DNA is unnecessary.**

The mRNA molecules are too large to diffuse out of the nucleus and so once they have been spliced, they leave via a nuclear pore. Outside the nucleus, the mRNA is attracted to the ribosomes to which it becomes attached ready for the next stage: Translation.