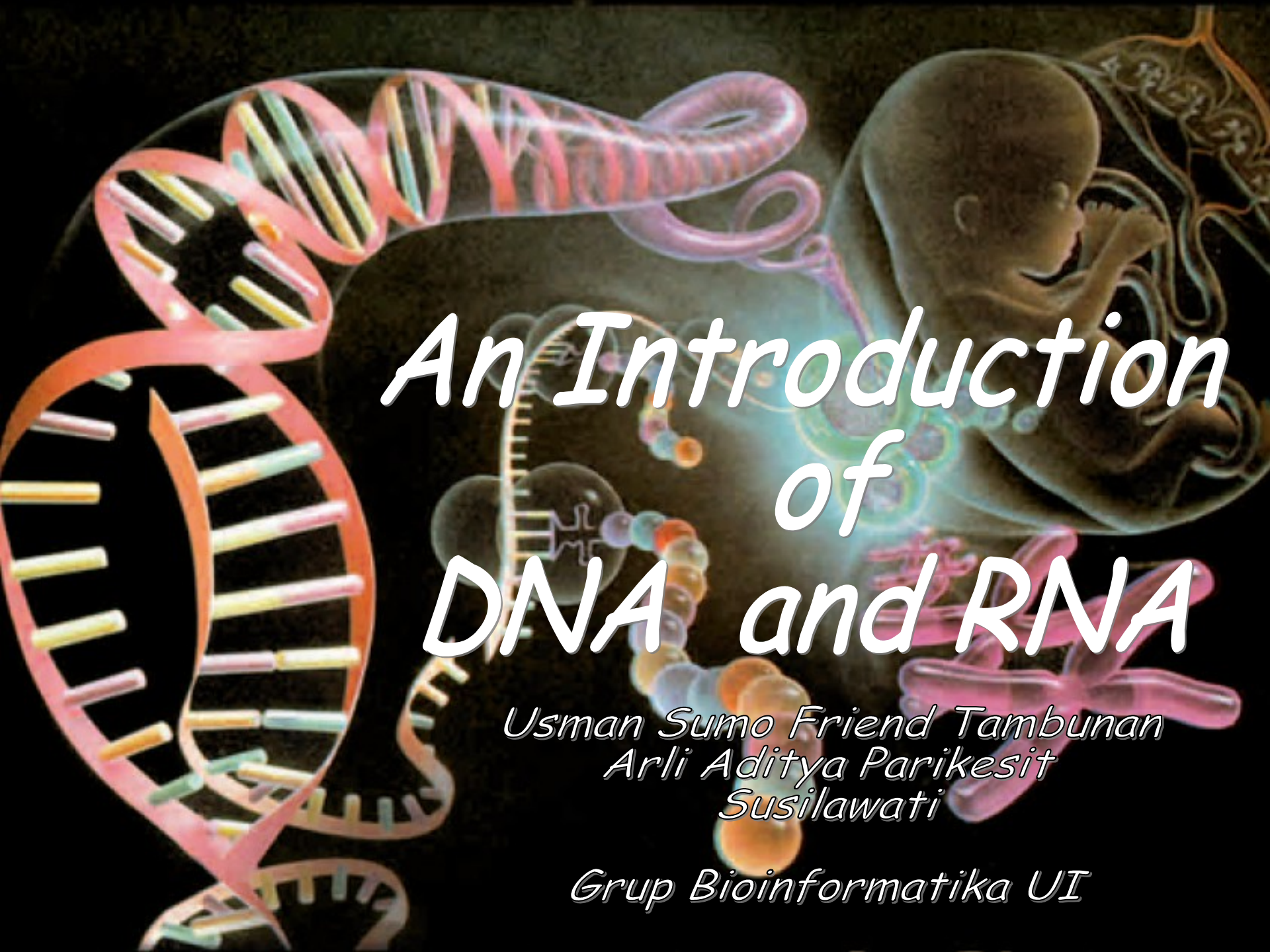


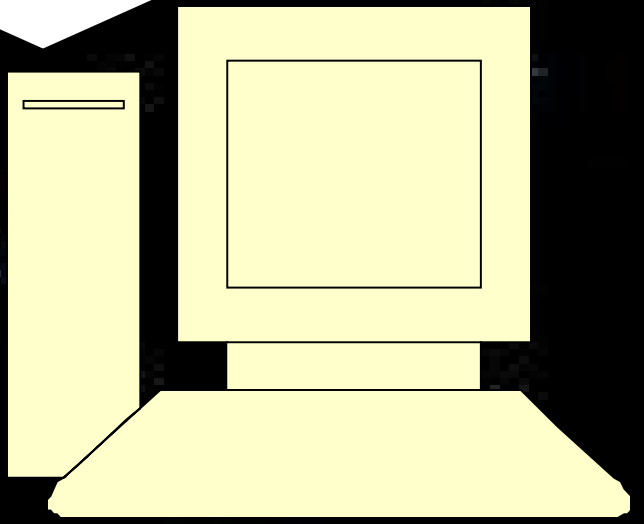
An Introduction of DNA and RNA

Usman Sumo Friend Tambunan
Arli Aditya Parikesit
Susilawati

Grup Bioinformatika UI

FLOW OF INFORMATION

DNA



DNA

DNA is a nucleic acid which acts as molecular repository for all genetic information

Chemically, DNA is a long polymer of simple units called nucleotides, with a backbone made of sugars and phosphate groups joined by ester bonds. Attached to each sugar is one of four types of molecules called bases

Historical landmarks in early DNA biochemistry

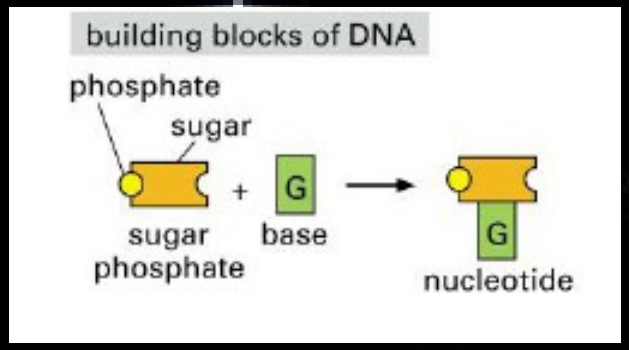
Year	Researcher (s)	Discovery
1868	Friendrich Miescher	Found substance “ nuclein “. It was suspected to be associated with cellular inheritance
1928	Frederick Griffith	Defined a “ transforming principle” in the pneumococcus bacterium
1944	Oswald Avery ; Collin MacLeod ; Maclyn McCarty	DNA is a component in chromosomes and the principal agent involved in the transfer of genetic information

1950	Erwin Chargaff	Studied the composition of DNA from different species and found the ratios of adenine to thymine and of guanine to cytosine to be 1.
Early 1950	Rosalind Franklin ; Maurice Wilkins	Studied X-ray diffraction of DNA crystals and found periodic patterns
1953	James Watson ; Francis Crick	Formulated a three-dimensional structure (double heliks) for DNA that accounted for X-ray diffraction and A=T, G≡C eqivalence data

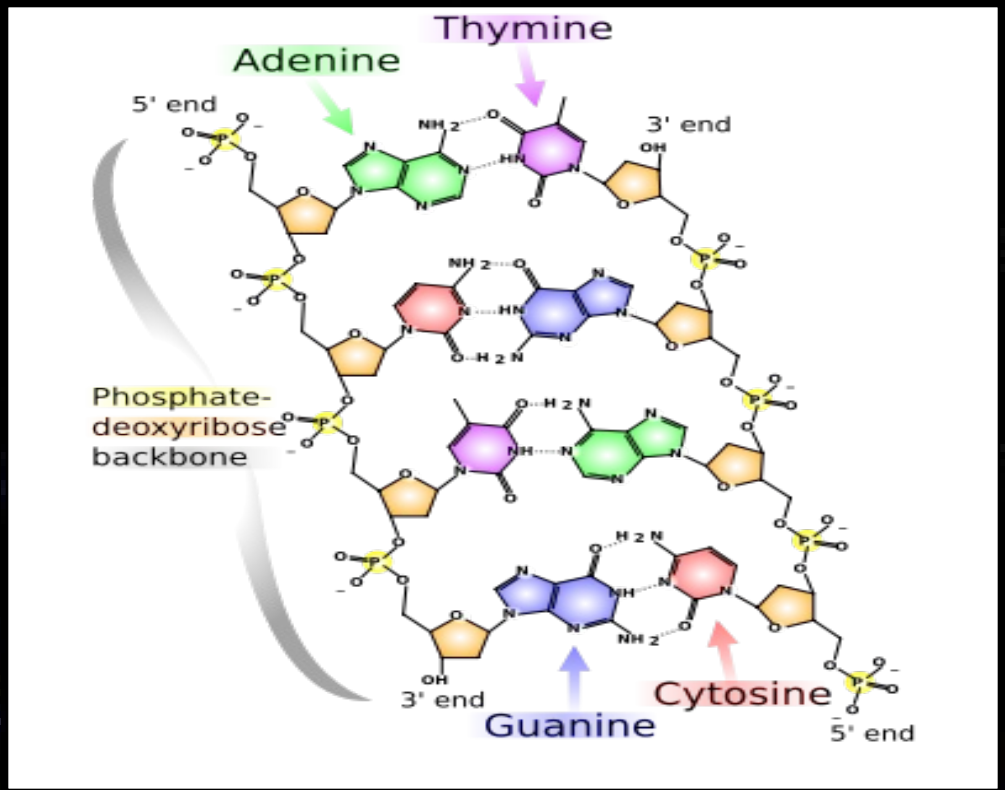
y DNA is chosen for this important role in the cell?How about RN

Let's find out from their each characteris tics

Characteristics of DNA

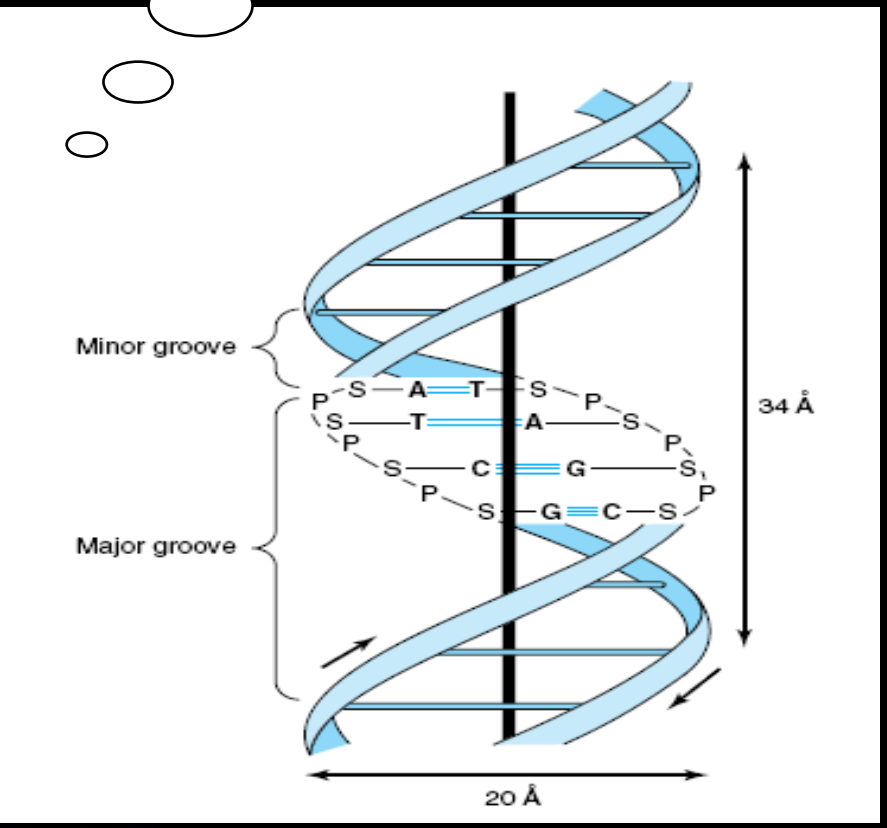


Building blocks

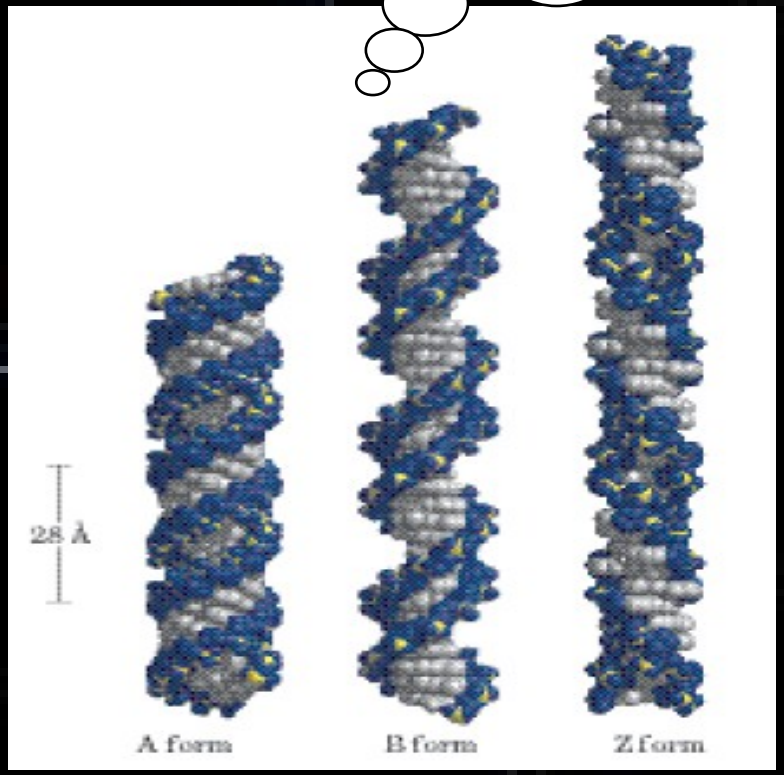


The Strands

Right Handed spiral Two Grooves



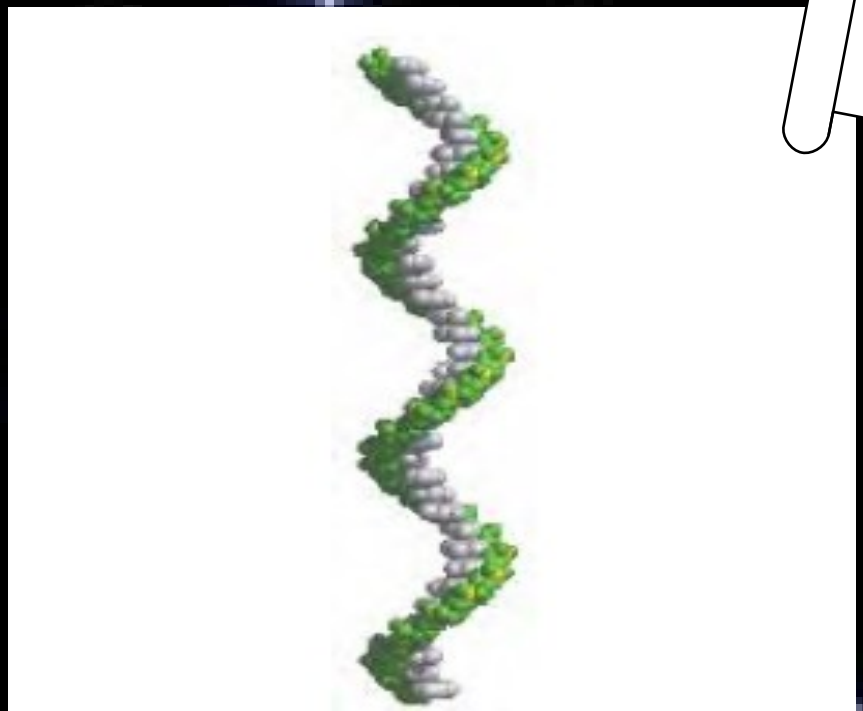
Three Dimensional form



	A form	*B form*	*Z form*
Helical sense	Right handed	Right handed	Left handed
Diameter	~26 Å	~20 Å	~18 Å
Base pairs per helical turn	11	10.5	12
Helix rise per base pair	2.6 Å	3.4 Å	3.7 Å
Base tilt normal to the helix axis	20°	6°	7°
Sugar pucker conformation	C-3′ endo	C-2′ endo	C-2′ endo for pyrimidines; C-3′ endo for purines
Glycosyl bond conformation	Anti	Anti	Anti for pyrimidines; syn for purines

RNA

- RNA is a nucleic acid molecule involving in “ decoding” information which implied in DNA.
- **Characteristics of RNA**



The Strand

Building Blocks

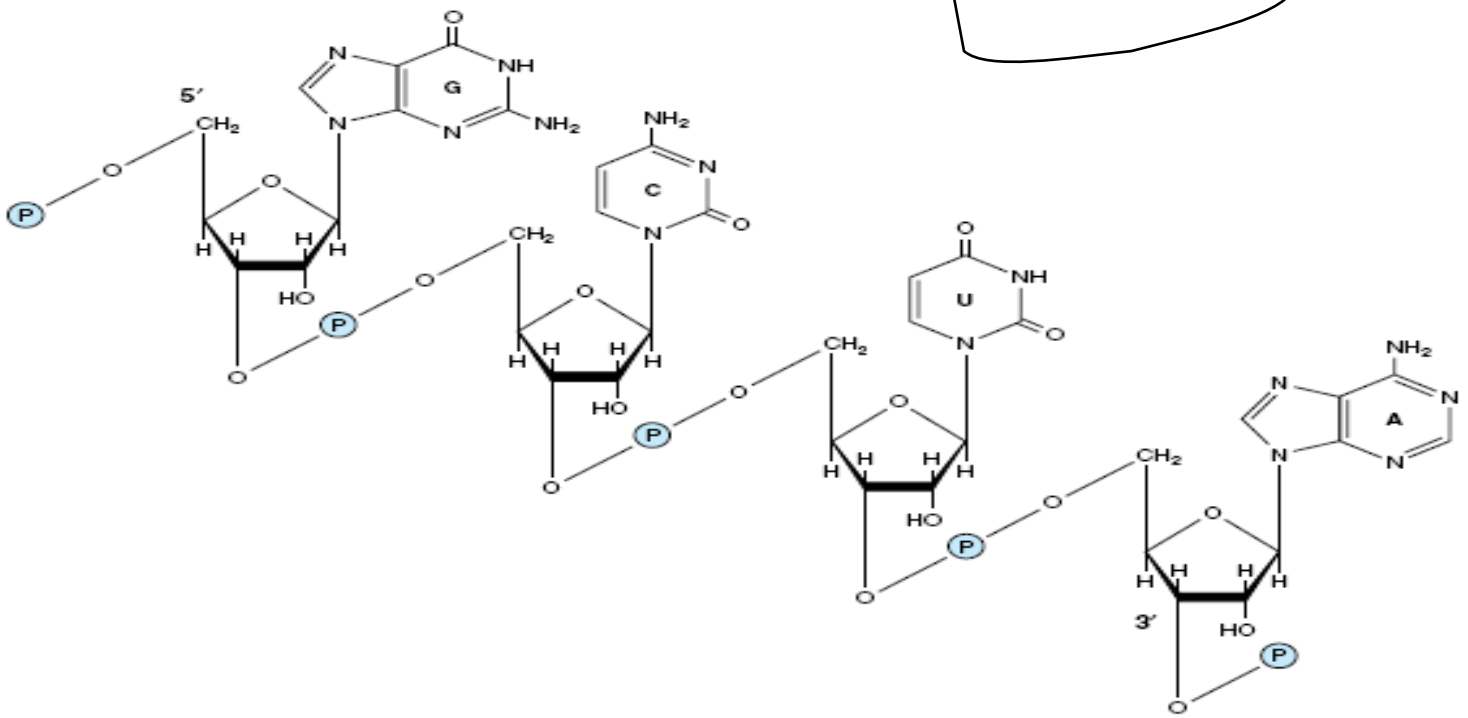


Figure 35–6. A segment of a ribonucleic acid (RNA) molecule in which the purine and pyrimidine bases—guanine (G), cytosine (C), uracil (U), and adenine (A)—are held together by phosphodiester bonds between ribosyl moieties attached to the nucleobases by *N*-glycosidic bonds. Note that the polymer has a polarity as indicated by the labeled 3′- and 5′-attached phosphates.

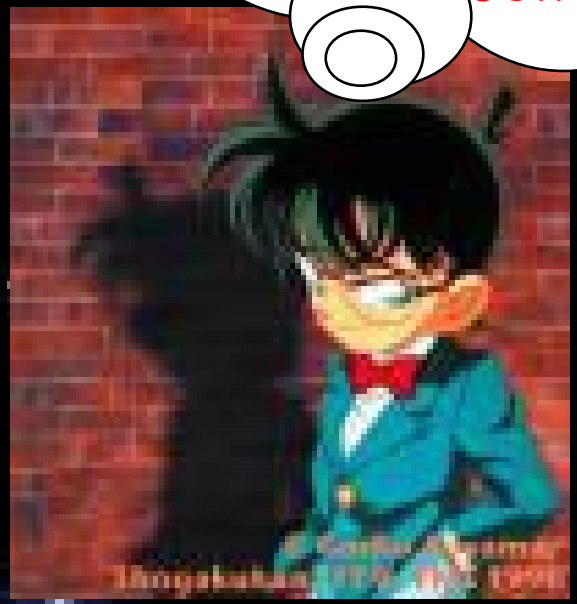
There are some molecules types RNA, including:

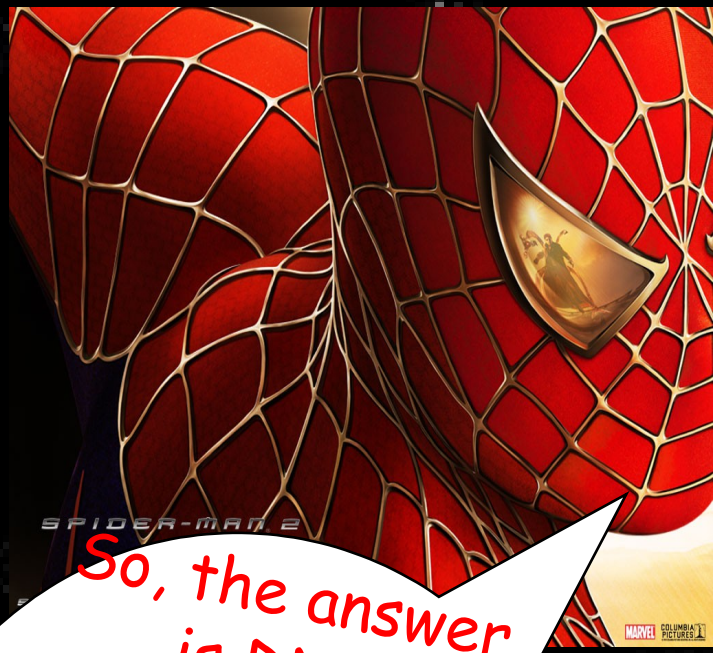
- Transfer Of RNA (tRNA)
- Ribosomal RNA (rRNA)
- Messenger RNA (mRNA)

Properties of three kinds of RNA

Type of RNA	Relative Size	Biological/chemical Function
Transfer	Small	Activates and cariers amino acids for protein synthesis
Ribosomal	Most are Large	Present with proteins in ribosomes, the cellular sites of protein synthesis
Messengger	Variable	Cariers direct message for synthesis of Protein

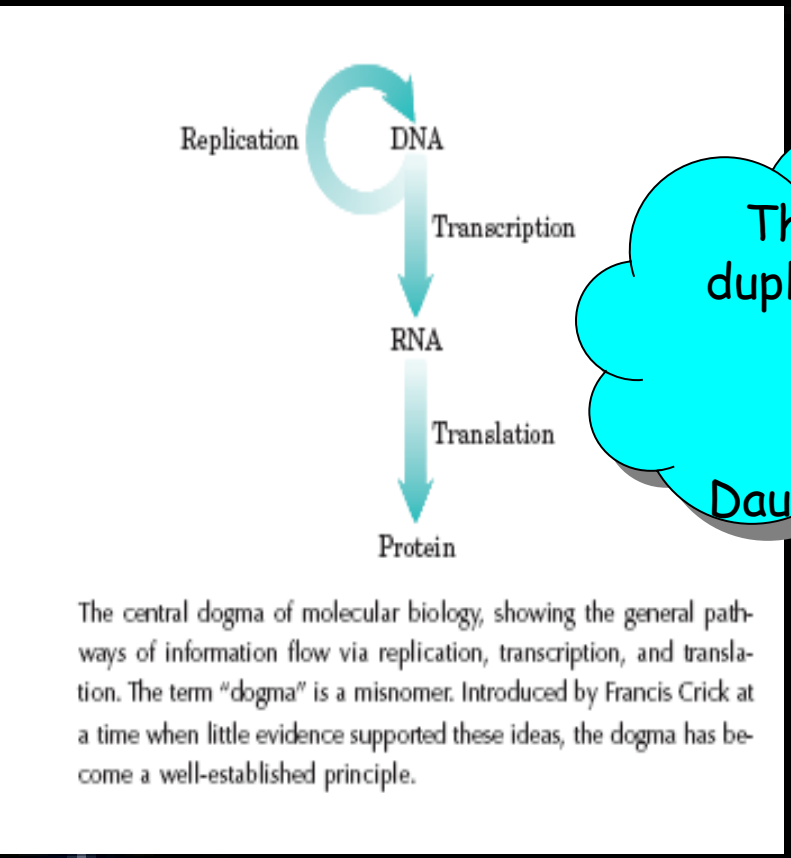
Yupz..the covalent bonds linking the individual nucleotide subunit are chemically stable, and not specially susceptible to hydrolitic cleavage in the aqueous environment in the cell





So, the answer is DNA molecule has been found to be especially stable intra- and extracellular conditions

Activity of DNA and RNA Central Dogma of Molecular Biology



The central dogma of molecular biology, showing the general pathways of information flow via replication, transcription, and translation. The term "dogma" is a misnomer. Introduced by Francis Crick at a time when little evidence supported these ideas, the dogma has become a well-established principle.

The Informational message is expressed in two important ways :

The exact duplication of DNA

cell division

Daugther cell

Expression of stored information to first manufacture RNA

Protein

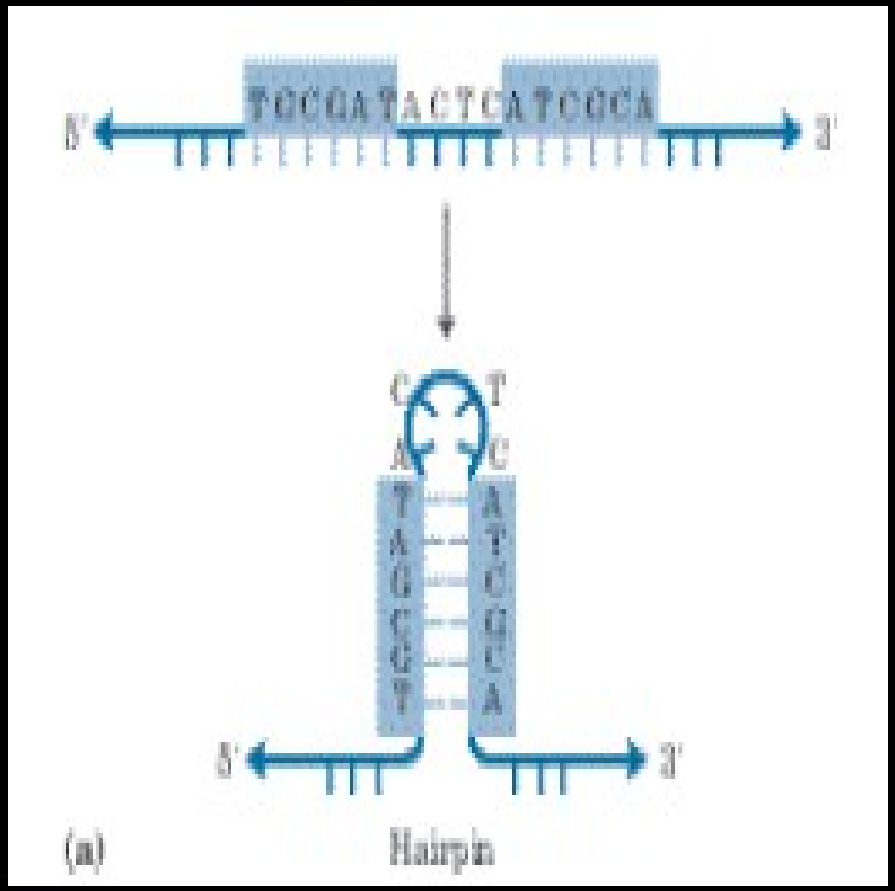
Certain DNA Sequences Adopt Unusual Structures

- This unusual structure is caused by Palindrome phenomenon in base sequences of DNA or RNA.
- A palindrome is a word, phrase, or sentence that is spelled identically read either forward or backward;
- For example: ROTATOR

- The term is applied to regions of DNA or RNA with inverted repeats of base pair sequence having twofold symmetry over the strands of DNA or RNA
- The palindromic **DNA** sequence

CCTGCXXXXXXXGCAGG

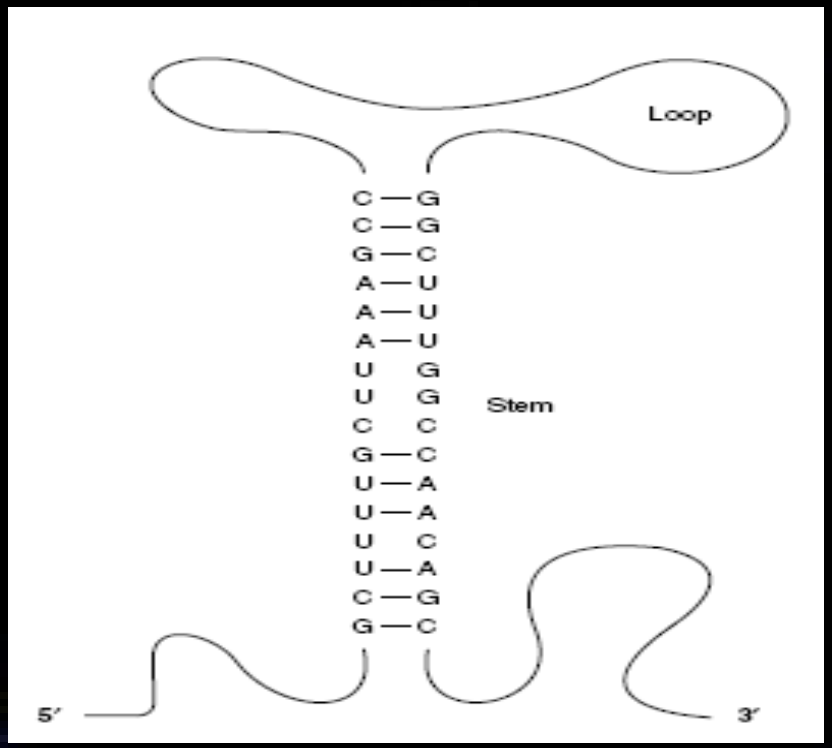
Palindromic DNA (or RNA) sequences can form alternative structures with intrastrand base pairing such a :

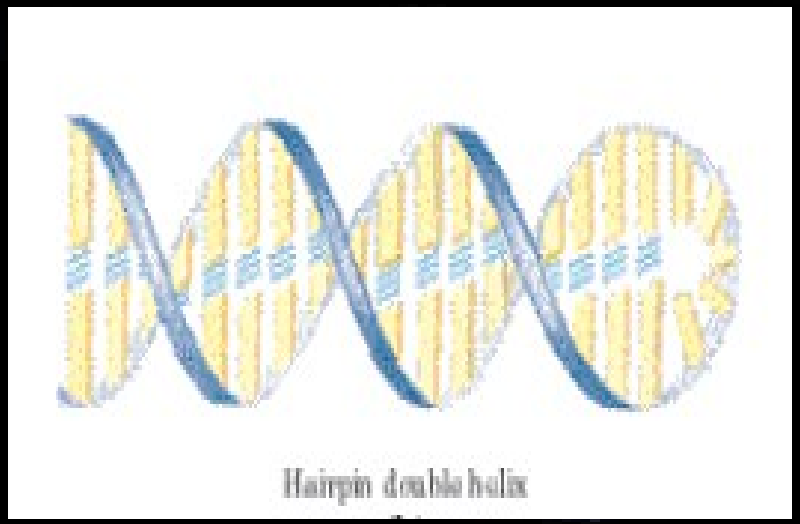


- Hairpin, or Stem-loop intramolecular

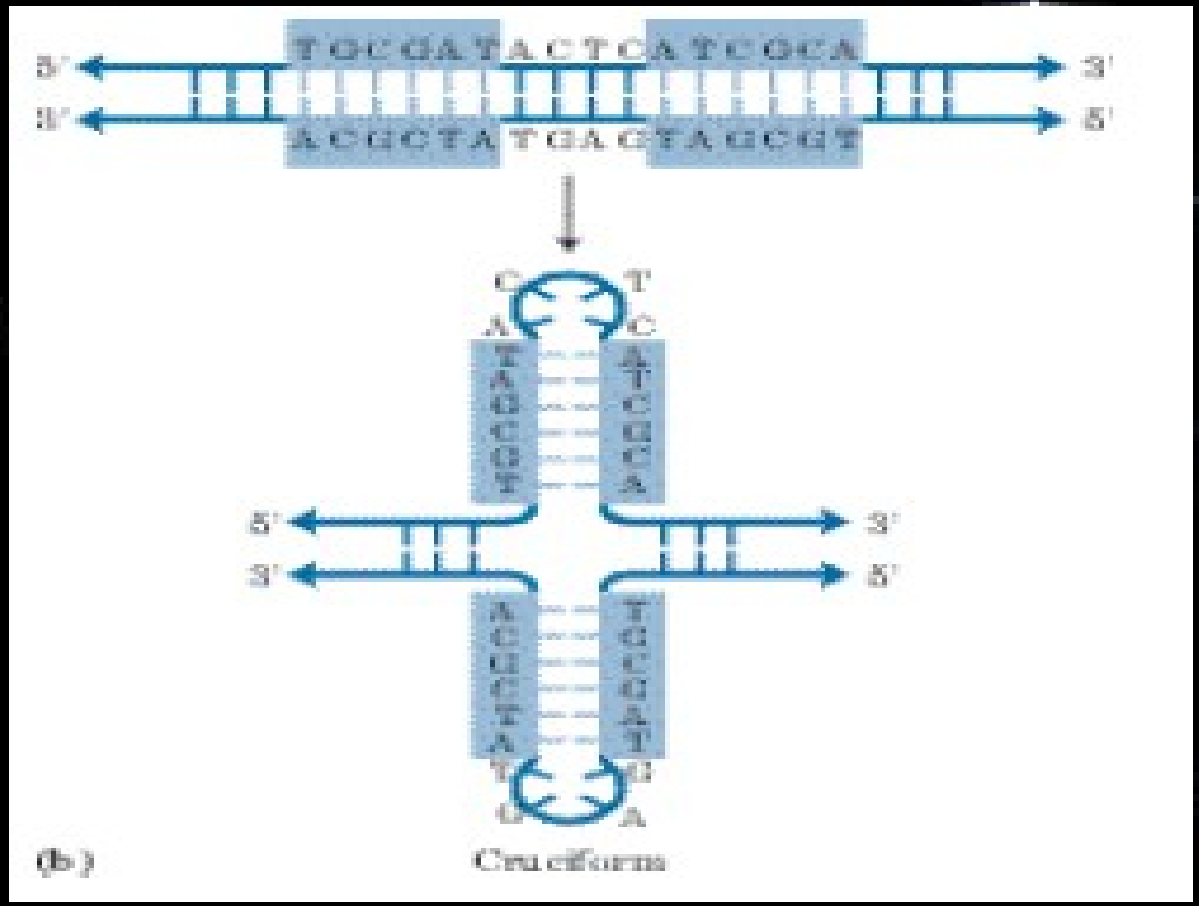
It occurs when two regions of the same molecule, usually palindromic in nucleotide sequence

- Hairpin in RNA make the single strand of RNA—as demonstrated in Figure —is capable of folding back on itself like a hairpin and thus acquiring doublestranded characteristics.





- Cruciform, the structure of DNA, when both strands of a duplex DNA are involved.



Conclusion
Differences DNA and RNA

Characteristic	DNA	RNA
length	DNA is significantly longer than RNA, because it stores all of the genetic information.	RNA is short because it carries one gene at a time.
number of strands	Two	one
location in cell	Nucleus only	Nucleus and cytoplasm
how it's made	DNA replication	transcription
sugar used	deoxyribose	ribose
nitrogenous bases	A, T, C, G	A, U, C, G

- Unusual structures can occur caused by palindromic base sequences.

Hairpin	Cruciform
One strands of DNA or RNA is involved	Both of the strands of duplex DNA are involved

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- http://en.wikipedia.org/wiki/DNA on 19 April 2008 at 11.00
- http://en.wikipedia.org/wiki/RNA on 19 April 2008 at 11.05

Thank you for your attention