Syllabus

→ DNA structure and organisation
→ RNA and non-coding RNAs
→ Basics of replication, transcription, & translation
→ DNA recombination & repair

Evaluation

→ Midsem (20)
→ Endsem (50)
→ Internal (30) → Class tests & Assignments
→ 15 + 15

References :

→ Griffiths

2/01/2023

DNA, RNA, 4 nitrogenous bases
difference b/w nucleotide & nucleoside

Learn structures for these. ⊛

→ You cannot break the phosphodiester bonds at boiling temp, as they are strong, covalent bonds

Boiling → disintegration ✗
denaturation ✓

→ Internal structures of RNA

→ functionality

↳ internal H-bonds

→ Alkaline hydrolysis of RNA

2'OH → deprotonation → O^- attacks Phosphodi bond → one base removed.

does not happen for DNA as no 2' OH

→ reason why RNA was chosen for genetic material ⊛

Info

Kossel → responsible for chemical structure of DNA & RNA

→ Three experiments for establishing DNA as genetic material

→ Tcells (1st innate immunity)

3/01/2023

→ Fidelity in replication
→ Scope for mutation
→ Proteins cant replicate → not DNA gen. mat.
→ Chargaff's rule
  → base comp. varies with organism
  → base comp. same all across org. & ages
  → base comp. $A + G = T + C$.

Alexander Todd → chemically established nature of phosphodiester bond.

Criss-cross str. in X-ray crystallography → helical

4/01/2023

1) DNA strand which is G-C rich takes higher temperatures to denature → more stable

2) A-C incompatibility due to H bond formation absence.

+ Chargaff's A=T & G=C data

→ complementary base pairing

(*) to be verified ☐

3) G-C : A-T ration > 1 → in most prokaryotes (is it because they have stable genom

4) Z-DNA found in recombining & genetically repressed parts of DNA ; A-DNA is very hard to find

5) Primer designing theory :

(a) melting temperature of DNA depends on :

→ length of strand

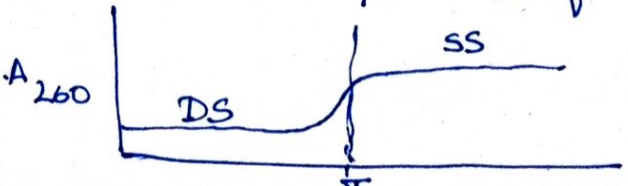
→ GC ration

→ change in solvent (not physiologically relevant)

(b) Accuracy of renaturation after removal of denaturant is inversely proportional to length of DNA

6) Double-stranded DNA has OD < SS DNA, because bases face inwards (minimal exposure)

↗ 50% of DNA is denatured



7) 100-base long ORF → protein coding gene
(at least 30 amino acids coreqd. → assumed)
→ difference b/w start and stop codon

8) No. of protein-coding genes cross-checked by proteomic profiling of 30 histologically normal human tissue samples (adult + foetal)
→ 84 % of total annotated protein coding genes accounted for.

Actually somewhere in between → because of small amounts of certain protein + maybe short half lives (?)

→ different in abnormal human tissue, proteome varies.

9) Looping in bacteria — 10 fold compaction.
1000-fold compaction → supercoiled DNA.

9/01/2024

DNA looping & supercoiling

1) Helps in 1000-fold compaction.

10 fold — looping
rest — supercoiling

2) Superhelix — when axis of DNA double helix coils on itself → new helix..

↓

also, supercoil → otherwise, DNA in relaxed state

↓

due to structural strain.

3) Purified ccD → rarely relaxed.

4) What is responsible for folding and maintenance of DNA supercoiling!

a) Linking no: defined as no. of complete revolutions one DNA strand makes around the other.

b) Supercoiling: when Linking no. differs from no in the relaxed state (twist

c) Negative supercoil → right handed
Positive supercoil → left handed.

d) Topoisomerases → cuts & reseals DNA to change Linking number
↳ in our body, helps in reducing supercoiling during replication.

Chromosome Discovery → Walther Flemming.

Lys & Arg → large proportion of Histon amino acids → Why? (20–40 %)

10/01/2024

→ Linker region varies from sp. to sp, but, no. of bp in core region remains same (147 bp)

→ Noll-Kornberg experiment

→ Difference b/w exonuclease and endonuclease.

→ Difference b/w extensive and light digestion forms the basis for the Noll-Kornberg experiment (# read the paper).

→ Why Is there any correlation b/w linker DNA length & species?

→ Most of the interactions b/w histones and DNA happen in the minor groove region.
↳ A-T rich (#)
major grooves → G-C-rich ↳ Why?

→ Tight wrapping of DNA around histone core requires removal of about one helical turn in the DNA (required to relax DNA during packing)

11/01/2024

→ DNA needs to be accessible to RNA polymerases for transcription (is this why A-T reg. bind to histones)

→ Bacterial gene density >>> us
↳ non-coding DNA

→ Gene - A region in DNA that encodes a gene product, either RNA / protein

→ RNA binds to basal transc. factors on non-coding strands,

→ Enhancer → enhances gene expression by looping and sitting on promoter, and ↑ strength of binding of RNA polymerase, when influenced by a particular protein

→ GENE = ORF + Regulatory sequence
↳ RNA much shorter

→ pseudogenes → missing a promoter

→ does LINE/SINE help in plasticity