Hello students.

I am Katelyn Gonsalves and today we will be going through

the module on models of replication

in prokaryotes and eukaryotes;

the linear model as part of the

second unit on DNA replication

in the molecular biology paper.

As part of this module,

we will go through the complexity of

the organization of eukaryotic DNA.

With emphasis on those features

that affect the replication

of linear eukaryotic DNA.

We will also talk about the existence

of multiple origins of replication

and the steps involved in the

linear model of DNA replication.

At the end of this session you

will be able to understand the

complexity of DNA organization

in eukaryotes and its role

on the replication process.

You will also be able to outline

the salient features of the linear

model of eukaryotic DNA replication.

The large amount of eukaryotic linear DNA.

Is tightly packaged in chromosomes

which are arranged in a special membrane

bound organelle called the nucleus.

These chromosomes contain

DNA along with proteins,

mainly basic proteins called histones,

made up of the amino acids

arginine and lysine.

The nuclear DNA protein complex dispersed

in the nucleus is referred to as

chromatin. When a cell undergoes division

this chromatin condenses and it assembles

to form

a species specific number of chromosomes.

DNA in eukaryotic chromatin when

isolated resembles a string of beads.

Each bead- like unit is called a nucleosome.

These nucleosomes pack into a condensed

super coiled chromatin structure.

which then further loop into chromosomes.

As you can see in the image,

the organization of DNA begins with

the double helical DNA structure

which winds around an octamer

of histone proteins

to form the beadlike nucleosome.

These nucleosomes then.

loop together,

coil together into chromatin fibers.

Which finally assembled at the time

of division into the chromatids

as part of the chromosome. Coming

now to DNA replication.

it is the process which forms the

basis for biological inheritance,

and it occurs before a cell divides

so as to ensure that both daughter

cells receive an exact copy of

the parent's genetic material.

This process of producing two identical

replicas from one original DNA involves

the double stranded DNA molecule,

the parent separating and functioning

as a template for synthesis of,

a new complementary strand,

a mode of replication referred to as the

semi conservative mode of replication.

The process of DNA replication

in eukaryotic cells.

Is very similar to the process

and the enzymes or proteins

involved in prokaryotic cells.

However,

the replication of eukaryotic

DNA is much more complex and this

is mainly due to three reasons.

One,

the presence of large amount

of linear DNA as chromosomes.

Two,

the existence of multiple origins of

replication per eukaryotic chromosome.

And three the tight packaging of DNA

in association with histone proteins.

The large amount of DNA and the

packaging of DNA and association with

proteins results in the replication

rate being much lower in eukaryotes

as compared to prokaryotic cells.

The process of eukaryotic DNA replication

like prokaryotic DNA replication

involves many proteins and enzymes

and goes through three main stages.

In the first stage initiation.

proteins bind to the origin of replication.

The enzyme helicase then

unwinds the DNA Helix,

forming two replication forks. In elongation.

a primer is added with

complementary RNA nucleotides.

DNA polymerase then

synthesizes new DNA.

The leading strand is

synthesized continuously,

while the lagging strand is made

discontinuously in the form of

fragments called Okazaki fragments.

In termination,

the RNA primers are finally removed

and replaced with new DNA nucleotides,

and the backbone is sealed.

by DNA ligase. In eukaryotic DNA replication.

the Association of the DNA with

histones and other proteins

requires the DNA first to be

made accessible to proteins and

enzymes involved in replication.

Replication then begins at a

specific location on the chromosome

called the origin of replication.

Eukaryotic chromosomes have

been found to have

multiple origins of replication.

An origin of replication may be found

every 10 to 100 micro meters of the DNA.

This is necessary to increase

the rate of replication.

Each of these origins defines a replicon;

which is the stretch of DNA replicated

as a unit from a particular origin.

As you can see in the image

the eukaryotic DNA molecule with

multiple origins of replication.

And at each of these replication origins,

you have replication forks which

move in opposite directions.

Replication is thus bi directional.

That is,

a pair of replication forks which start

at the origin move in opposite directions.

The movement of the replication folks causes

bulges in the DNA replication.

These are often called replication

bubbles. As replication proceeds

these replication bubbles grow in size.

And the adjacent replication

bubbles then fuse.

This image shows you the various steps

involved in the linear model of replication.

In eukaryotes you have linear

eukaryotic DNA with replication origin.

which is the place at which

the DNA separates out and replication begins.

Replication forks then move,

creating the formation of

the replication bubbles.

The existence of multiple origins causes

a number of replication bubbles to be

formed on the eukaryotic DNA molecule.

Finally, as replication bubbles grow in size

adjacent bubbles enlarge and fuse.

That is,

they join up forming duplicate

strands. Through the linear

model of replication in eukaryotes

a linear parental helical DNA molecule

separates and functions as templates

to form linear double helical

daughter DNA molecules through the

semiconservative mode of replication.

These are my references,

thank you.