Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (Third year)

Subject: Zoology

Paper Code: ZOC 107

Paper Title: Molecular Biology and Evolution

Unit: Unit 1 – DNA Replication and Repair mechanism

Module Name: DNA Replication in Eukaryotes- Semi-conservative, Bidirectional and Semi-discontinuous

Module No: 06

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Notes:

During semiconservative DNA replication, each strand of the double helix separates out and acts as a template for the synthesis of the new DNA strand, at the end of the replication process each double helix will have one parental strand and a new daughter strand, therefore at each cycle one strand is conserved, that is to say that DNA is half or semi conserved at each replication cycle.

Bidirectional replication takes places in eukaryotes. Eukaryotes have multiple origins of replication, so as to speed up the process of replication. Bidirectional replication involves replicating DNA in two directions at the same time resulting in a leading strand (were replication occurs more rapidly) and a lagging strand (with slower replication). Eukaryotic chromosomes have two replication forks which are the regions where nucleotides are actively added to growing strands. If there are two replication forks, one at each end of the replication bubble, the forks proceed outward in both directions in a process called **bidirectional replication**, At all replication origins, replication takes place bidirectionally, i.e replications that moves away from a single origin of replication, forming of 'replication

bubbles'. These bubbles grow in size as replication continues. Eventually, two replication forks (at each end of a bubble) meet, at which point they fuse together producing a larger bubble. Finally, all the replication bubbles along the chromosome merge into one large bubble joint only at the telomeric region, these split to give two identical strands of DNA.

As DNA unwinds, the template strand that is exposed in the 3'→5' direction permits the new strand to be synthesized continuously, in the 5'→3' direction. This new strand, which undergoes **continuous replication**, is called the **leading strand**.
The other template strand is exposed in the 5'→3' direction. After a short length of the DNA has been unwound, synthesis proceeds in 5'→3'; that is, in the direction *opposite* that of unwinding, but in short segments called the Okazaki segments. This is the lagging strand.

This process is repeated again and again, and so synthesis of this strand is in short, discontinuous fragments. The newly made strand that undergoes **discontinuous replication** is called the **lagging strand**. Since replication takes place on one strand in a continuous manner and on the other in a discontinuous manner, DNA replication is said to be semi-discontinuous.