**Yeast artificial chromosomes (YAC)**

The major limitation of most of the vectors is size limit of the DNA that can be cloned into them. YAC vectors allow the cloning, within yeast cells, of fragments of foreign genomic DNA that can approach 500 kb in size. YAC is essentially a pBR322 plasmid into which a number of genes have been inserted.

The essential functional components of YAC are:

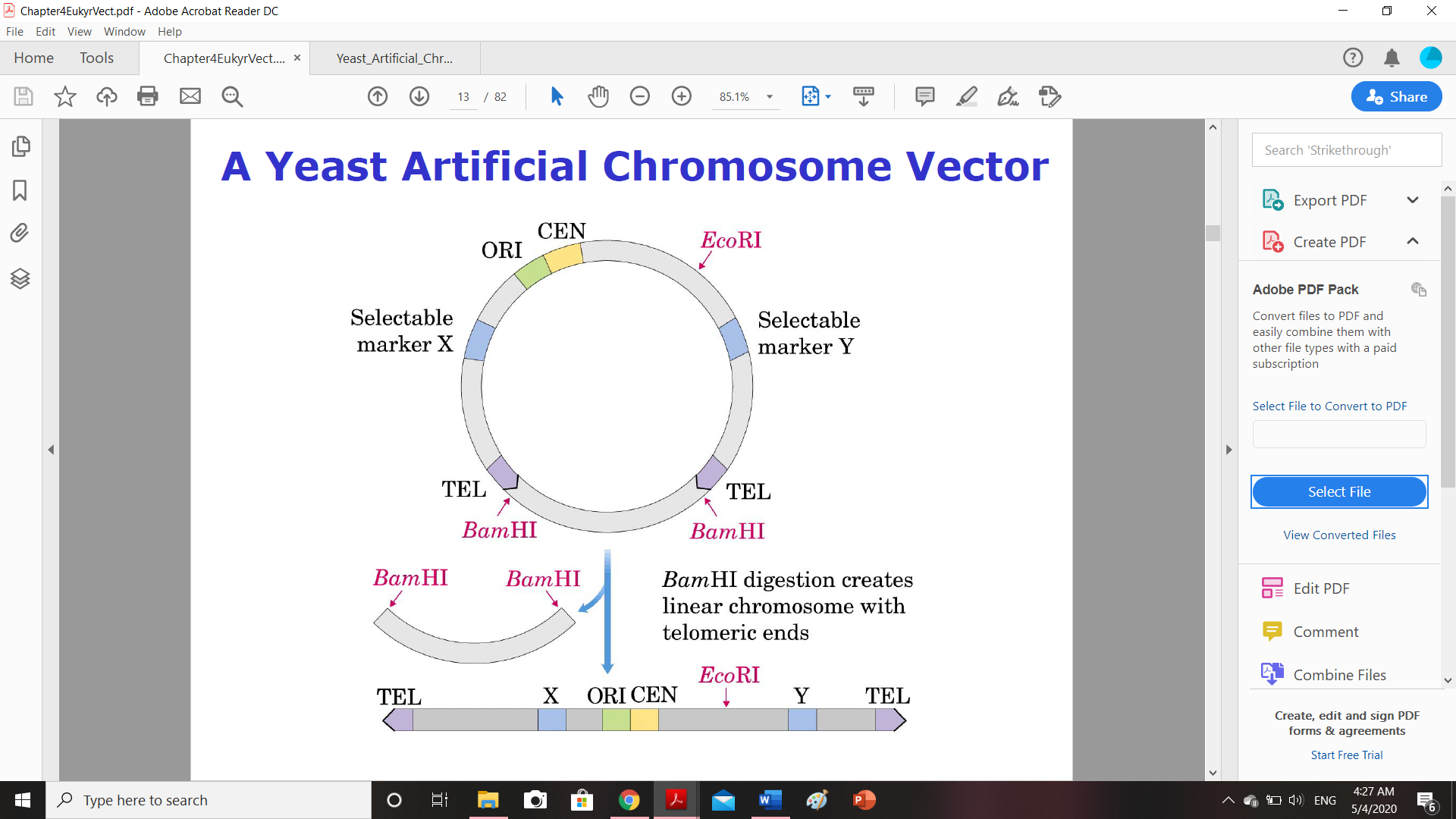
Centromeres: it is required for the disjunction of sister chromatids in mitosis and of homologous chromosomes at the first meiotic division.

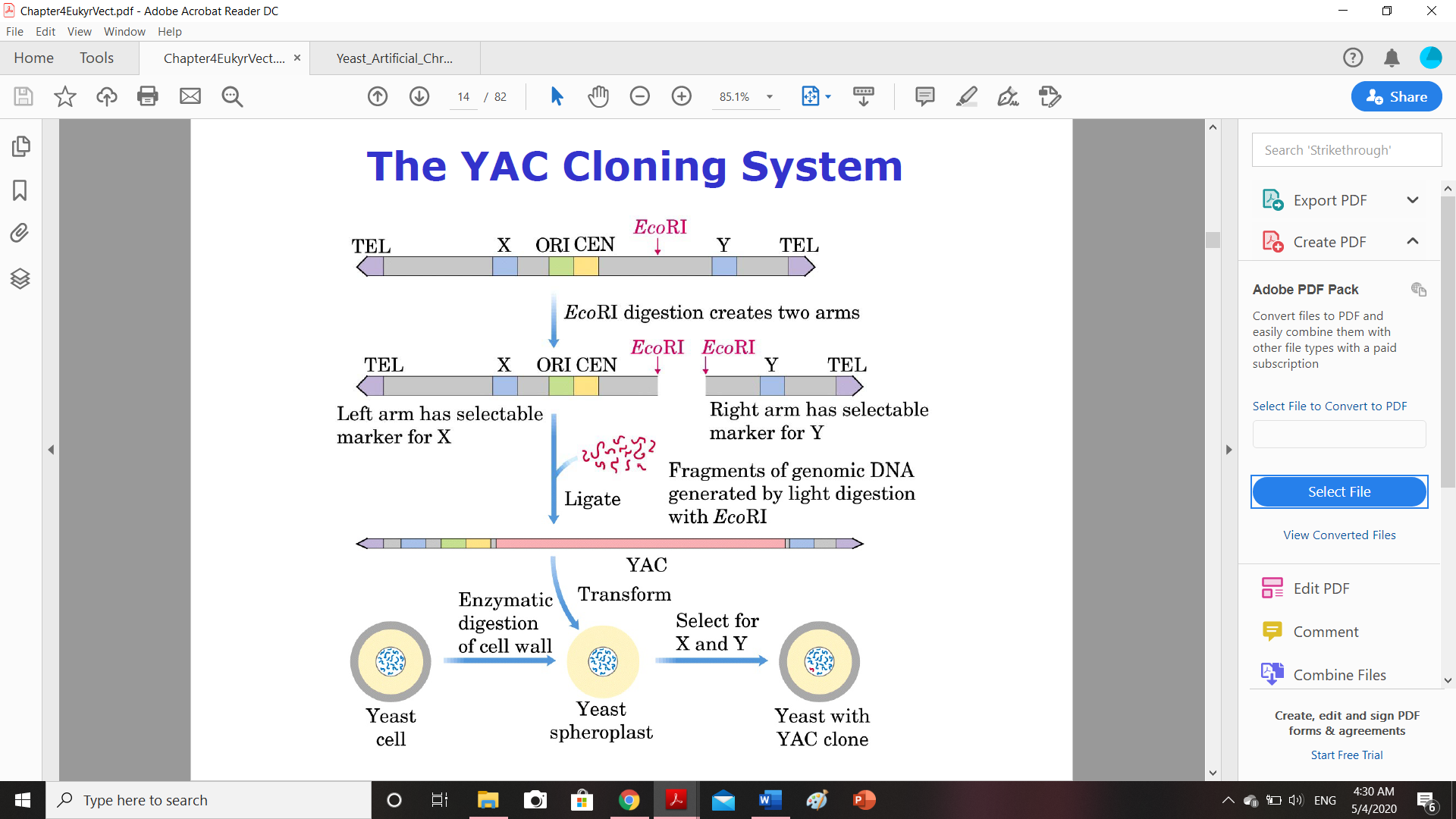
Telomeres: the structure at the ends of a chromosome, which are needed in order for the ends to be replicated correctly and which also prevent the ends of the chromosome from exonuclease attack.

Autonomous replicating sequence (ARS) elements: the origin of replication which are the positions along the chromosome at which DNA replication initiates.

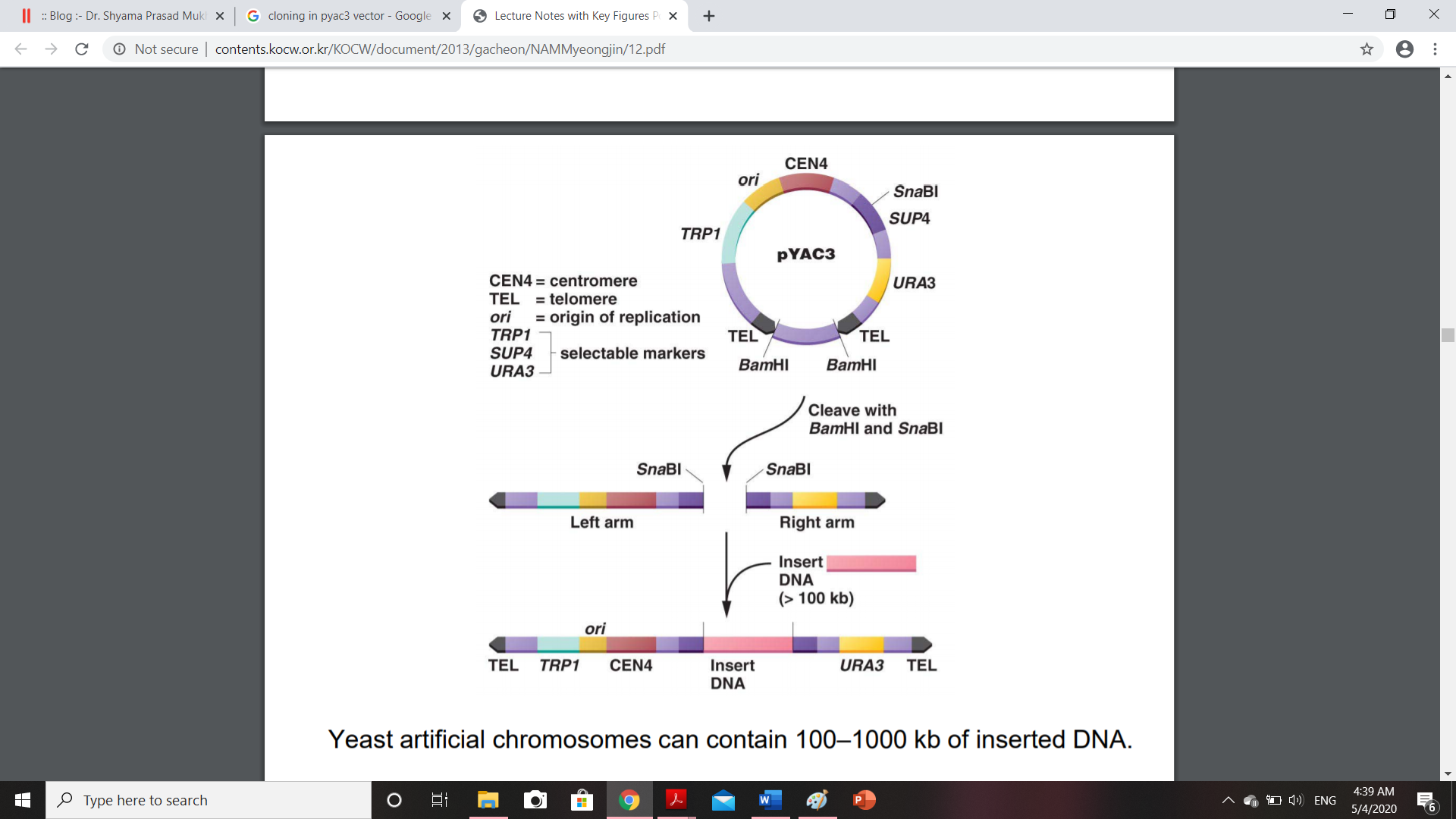
Selectable marker: It is a gene for YAC selection in yeast. The vector has a functional copy of URA3, a gene involved in uracil biosynthesis, and TRP1, a gene involved in tryptone biosynthesis that allow selection of yeast cells that have taken up the vector.

Bacterial replication origin and bacterial selectable marker: in order to propagate the YAC vector in bacterial cells, YAC vectors usually contain the ColE1 origin of replication and the ampicillin resistance gene foe growth and analysis in *E. coli.*





**A typical example of an yeast artificial chromosome is is PYAC3.**



**Use of Yeast Artificial Chromosomes**

YAC vectors were initially created for the cloning of large exogenous DNA segments in S. cerevisiae but soon became chromosomal-like platforms for a variety of in vivo experiments. Applications of YACs range from generating whole DNA libraries of the genomes of higher organisms to identifying essential mammalian chromosomal sequences necessary for the future construction of specialized mammalian artificial chromosomes (MACs). The availability of YAC libraries has greatly advanced the analysis of genomes previously cloned in cosmid vectors. For example, YAC clones have been used as hybridization probes for the screening of cDNA libraries, thus simplifying the characterization of unidentified genes.

**References**

* Life Sciences by Pranav Kumar and Usha Mina Pathfinder publication.
* Gene coning and DNA analysis by T.A. Brown