Difference Between VNTR and STR

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Key Difference – VNTR vs STR

DNA studies have immense utility in understanding and determining phylogenetic relationships, diagnosing genetic diseases and mapping organism's genomes. Several techniques associated with DNA analysis are used for the identification of a particular gene or a DNA sequence in a pool of unknown DNA. They are known as genetic markers. Genetic markers are used in molecular biology to identify genetic variation between individuals and species. Variable number tandem repeat (VNTR) and short tandem repeat (STR) are two types of genetic markers which show polymorphism among individuals. Both types are non-coding repetitive DNA which are tandem repeats. They are arranged in a head to tail fashion in chromosomes. VNTR is a section of the genome where short nucleotide sequence is repeated several times. STR is another section of DNA within the genome which is organized as repeating units consisting of two to thirteen nucleotides in hundred times. The key difference between VNTR and STR is the number of nucleotides in a repeating sequence. **Repeating units of VNTR consists of 10 to 100 of nucleotides while repeating unit of STR consists of 2 to 13 nucleotides**. VNTR and STR are used widely in forensic studies.

What is VNTR?

A tandem repeat is a short sequence of DNA that is repeated in head to tail fashion at a specific chromosomal locus. There is no other sequence or nucleotide within the tandem repeat. There are several types of tandem repeats in the genome. VNTR is a type of tandem repeat among them which has repeating units consisting 10 to 100 nucleotides. VNTR is a type of minisatellite. These tandem repeats can be found in many chromosomes. They are interspersed within the human genome and are situated predominantly in the subtelomeric regions of chromosomes.

VNTRs show tandem repeat polymorphism among individuals. The length of the VNTR in a particular location of the chromosome is highly variable among individuals due to the variation in the number of repeating units organized in that DNA section. Therefore, VNTR can be used as a powerful tool in the identification of individuals and VNTR analysis is utilized in many fields including genetics, biology research, forensics and DNA finger printing. VNTRs were the first genetic

markers used to quantify bone marrow transplant engraftment. VNTRs were also the first polymorphic markers used in DNA profiling in forensics.

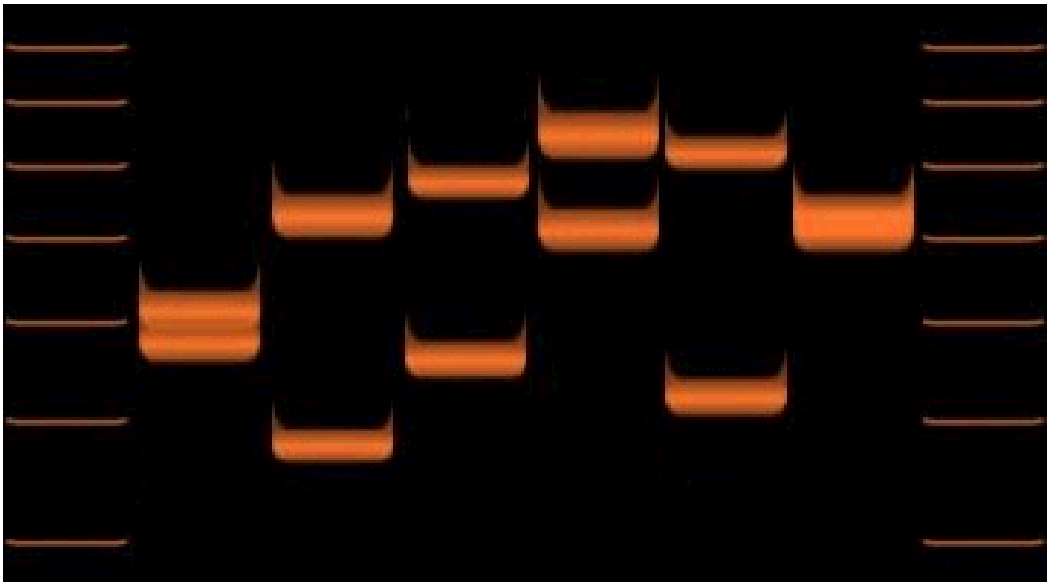

Figure 01: Variation of VNTRs in six individuals

VNTR analysis is performed via restriction fragment length polymorphism followed by southern hybridization. Hence, it needs comparatively a big DNA sample. VNTR profile interpretation is also problematic. Because of these limitations, the use of VNTR in forensic genetics has been limited and it is replaced by STR analysis.

What is STR?

STR is a highly repetitive DNA section which consists of two to thirteen nucleotide repeating units organized in a tandem manner. STR is similar to VNTR. But it varies from VNTR from the number of nucleotides in a repeating sequence and the number of repeats. STR is a type of microsatellite.

STR analysis involved in measuring the exact number of repeating units. STRs are highly variable among individuals, similar to VNTs. STR profiles differ from person to person. Therefore, STR analysis is used in molecular biology to compare specific loci on DNA from two or more samples. Hence STRs are considered as powerful genetic markers in molecular biology. It provides an excellent tool for identification of individuals because of their high degree of polymorphism and relatively short length.

At present, STRs are the most commonly used analyzed genetic polymorphism tool in forensic genetics. Most forensic casework involve STR polymorphic analysis. STR loci are spread throughout the genome. There are thousands of STRs located in chromosomes which can be used in forensic analysis. STR analysis does not involve restriction length polymorphism like VNTR analysis. STR analysis does not cut DNA with restriction enzymes. Specific probes are used to attach desired regions on DNA and using PCR technique, the lengths of the STR are determined.

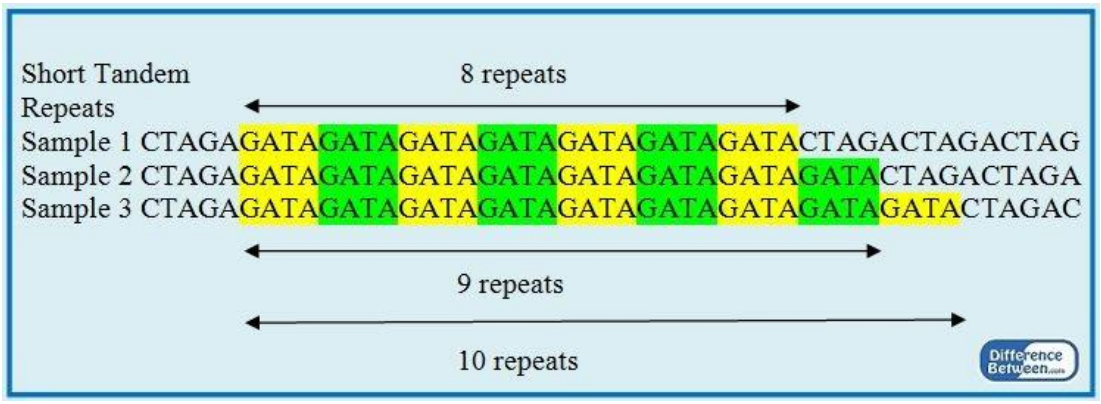

Figure 02: STR variation between samples

What are the similarities between VNTR and STR?

- VNTR and STR are noncoding DNA.
- Both are tandem repeats.
- Both show polymorphism among individuals due to the difference in the length of the DNA section.
- Both are used as powerful genetic markers in DNA finger printing and in forensic studies.

What is the difference between VNTR and STR?

VNTR vs STR	
VNTR is a noncoding repetitive DNA which has a short nucleotide sequence repeated in a tandem manner.	STR is a highly repetitive DNA section which consists of two to thirteen nucleotide repeating units organized in a tandem manner.
Size	

VNTRs are larger than STRs.	STRs are smaller than VNTRs.
Number of Nucleotides in Repeating Sequence	
The repeating unit of VNTR consists of 10 to 100 nucleotides.	The repeating unit of STR consists of 2 to 13 nucleotides.

Summary – VNTR vs STR

VNTR and STR are two powerful genetic markers used in molecular biology, especially in the field of forensic genetics. VNTR is a type of minisatellite and STR is a microsatellite. VNTR and STR are noncoding, highly repetitive DNA. They are tandem repeats. The general structure of VNTR and STR are the same. However, the number of nucleotides in the repeating sequence and the length are different. VNTR has repeating sequences consist of 10 to 100 nucleotides. STR has repeating sequences consisting of 2 to 13 nucleotides. This is the difference between VNTR and STR.

References:

1. “The Science of Forensic Genetics.” CRG – Council for Responsible Genetics. N.p., n.d. Web. Available here. 10 July 2017.
2. “STR analysis.” Wikipedia. Wikimedia Foundation, 22 Mar. 2017. Web. Available here. 10 July 2017.

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