DNA is Individual Evidence

- Individuals have unique patterns of repeatied base sequences in the noncoded DNA, and certain base sequences may be repeated many times. DNA sequences have different lengths and different sequences of the bases in different individuals. Within a human population, these differences in DNA sequences are called polymorphisms.
- Basis a forensic point of view, DNA sequences with a high degree of polymorphism are most useful for DNA analysis.

History of DNA in Forensic Science

- In 1984, Dr. Alec Jeffreys at the University of Leicaster observed that DNA from different individuals contains different polymorphisms. His laboratory developed a technique for isolating and analyzing these variable areas that is known as DNA fingerprint or DNA profiling.
- This was used for paternity testing and forensics.

- When the amount of evidence left at a crime scene is very small, it is considered to be trace evidence. One of the problems encountered in dealing with trace evidence is that the evidence may be totally consumed during forensic testing. The use of polymerase chain reaction (PCR) technique helps resolve this problem.
- Dr. Kary Mullins invented the PCR technique, for which he shared the Nobel Prize in 1993.

PCR Basics

Objectives:

- Describe the forensic utility of polymerase chain reaction (PCR)
- Identify the components of PCR
- Explain the process of PCR

Polymerase Chain Reaction

Abbreviated PCR

Used to amplify small quantities of DNA (µg quantities) to generate large samples for analysis.

Used forensically for DNA fingerprinting.

For what are we looking?

Variable Number Tandem Repeats (VNTRs):

VNTRs are segments of repeated DNA.

VNTRs for each genetically different person are nearly unique.

Inherited from mother and father.

Are there any people who share the same VNTR's?

How could this be useful forensically?

Identical twins have the same VNTRs

Less than 1 in 20 billion chance that two people match.

Steps of PCR

1) Denaturation

- DNA Strands Separate

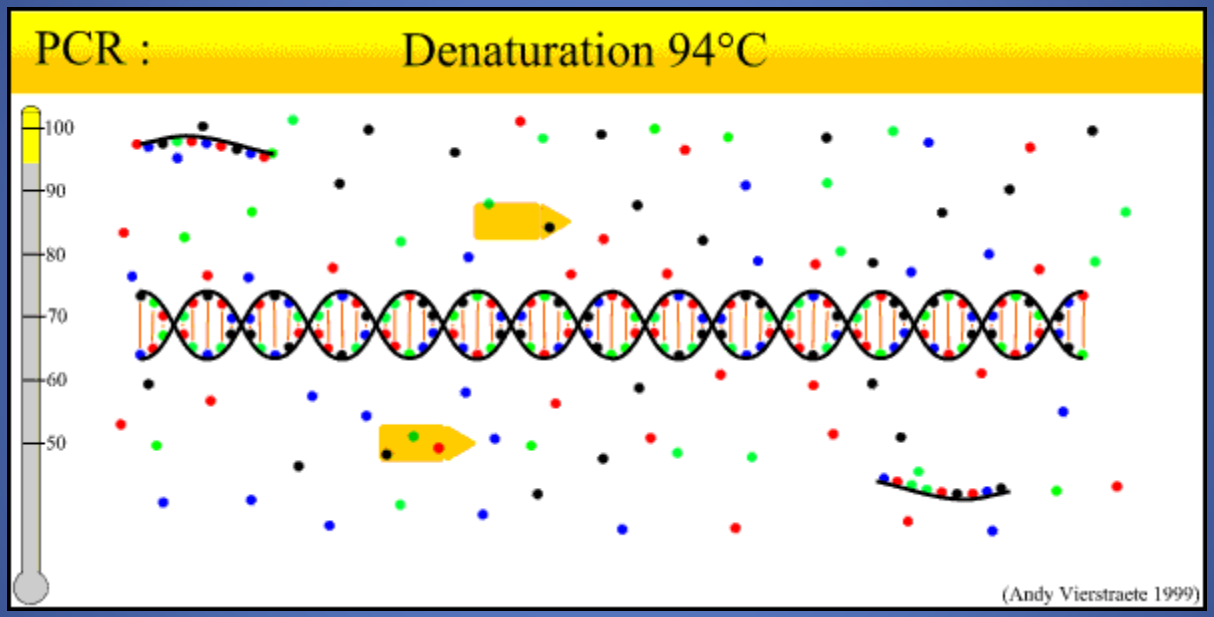
2) Annealing

- Primers bond to DNA Strands

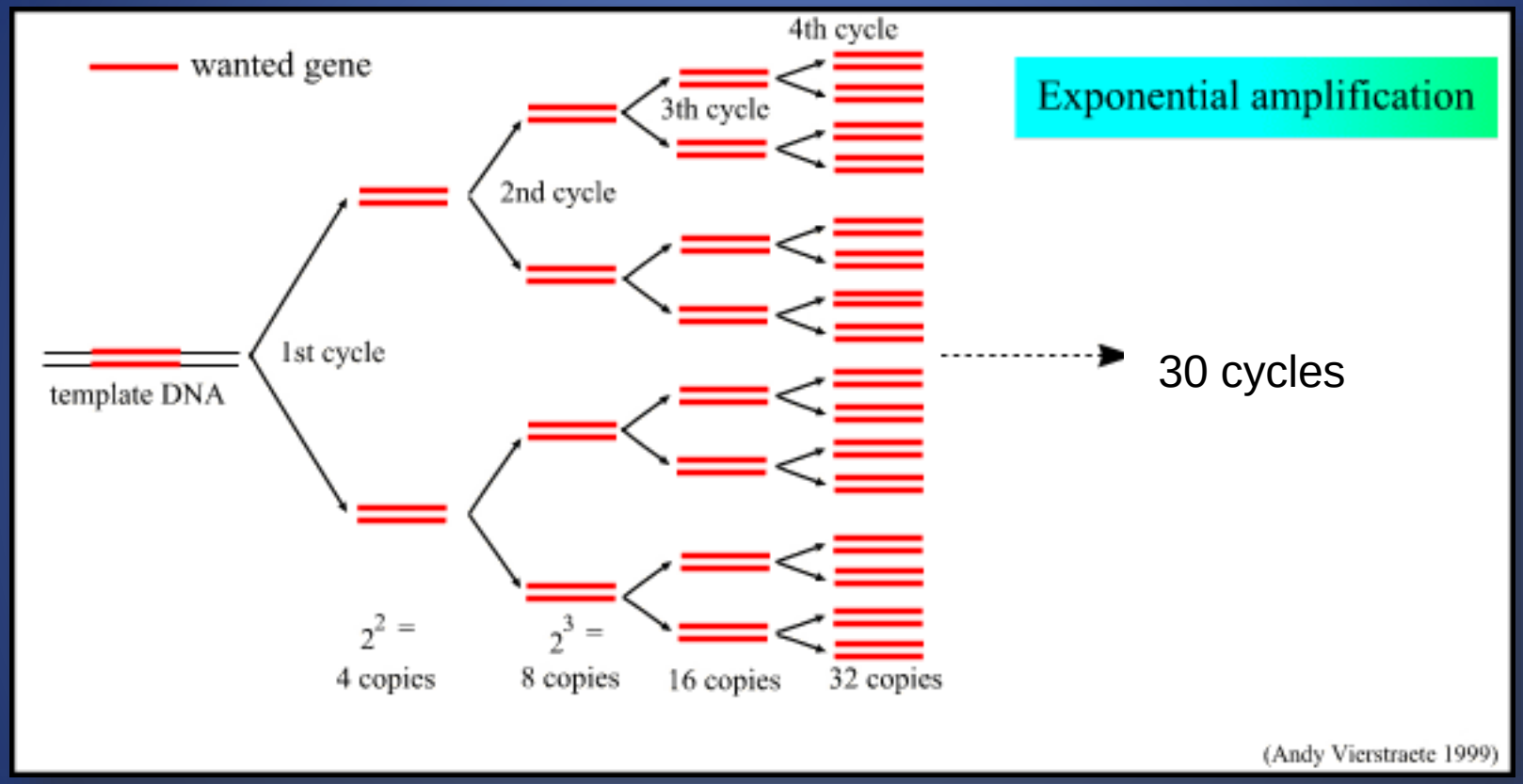
3) Elongation

- New complementary strands are formed

PCR Amplification

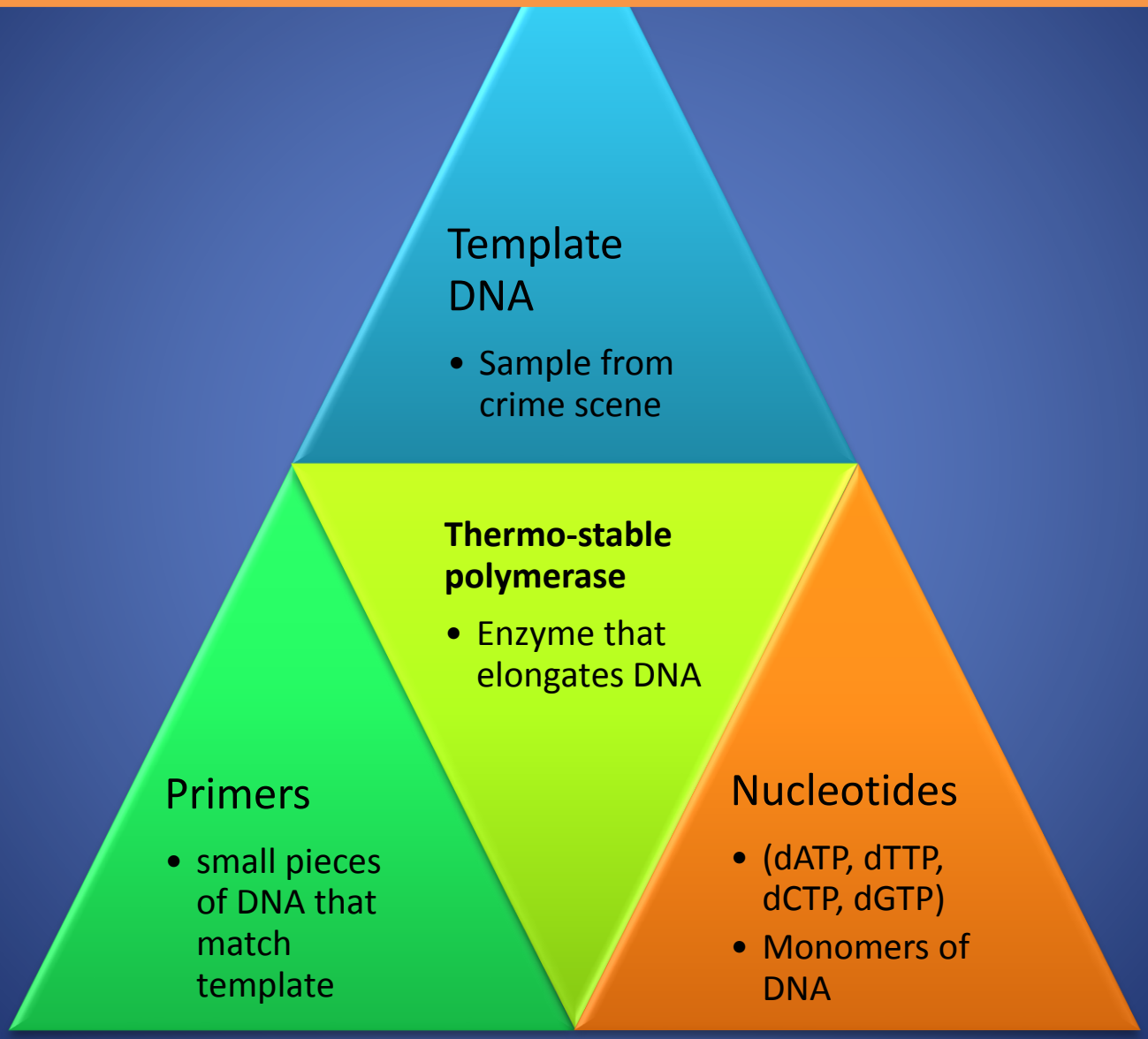


Exponential Amplification



30 cycles = 2^30 = 1.1 billion copies in theory

Components of PCR



Primers

Must complement both strands

Usually Palindromes

(ex. TAGCTA)

- Length (17-28 base pairs)

High G and C content

- 50-60%
- More Stable Bonds

The choice of primer determines the sequence that is amplified.

Temperature

The high temp polymerase comes from an archaebacteria

The key to PCR is oscillating temperatures.

The process was developed in 1983 by Kary Mullis

Resulted in a Nobel Prize

Practice

1. Write out the steps of PCR in order.
2. Describe the role of primers in PCR.
3. How could PCR be used forensically?

Answers

1. PCR Steps: Denaturation, Annealing, Elongation

2. Primers: determine the sequence to be amplified

3. PCR – used for paternity, victim identification, linking criminal to crime scene