

# How TrueAllele® Works (Part 2) Degraded DNA and Allele Dropout

Cybergenetics Webinar  
November, 2014

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Cybergenetics, Pittsburgh, PA



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## READING EAGLE

Originally Published: 2/19/2009 5:56:00 PM



### Reading man accused of killing woman on grounds of Wernersville hospital held for court

Reading Eagle

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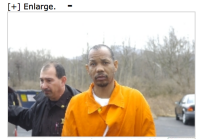
A Reading man accused of killing a Lebanon woman last May on the grounds of Wernersville State Hospital was held for court Thursday.

A preliminary hearing was held Thursday afternoon for Glenn Lyons at the South Heidelberg Township office of District Judge Ann L. Young.

Lyons is accused of killing Kathy A. Leibig, with whom police said he was having an affair.

Leibig was found in the back of her SUV in a parking lot near Wernersville State Hospital, police said. She had been stabbed 30 times, according to investigators.

Testimony was given from several prosecution witnesses, including a man who said Lyons spent the days following the killing on a drug binge.



Reading Eagle: Ryan McFadden  
Glenn Lyons is accused of killing Kathy A. Leibig, with whom police said he was having an affair.

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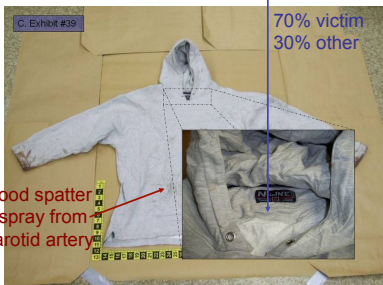
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## Commonwealth v. Lyons

homicide: DNA mixture evidence



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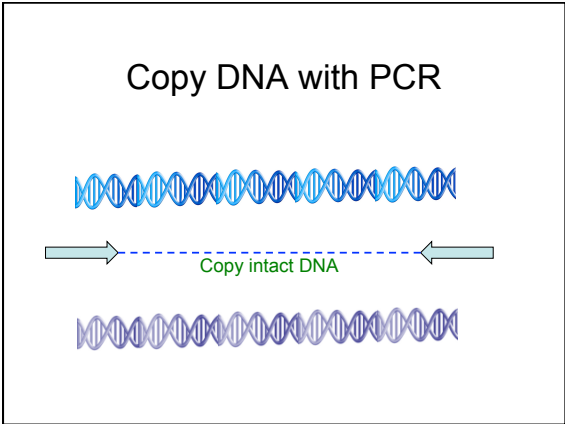
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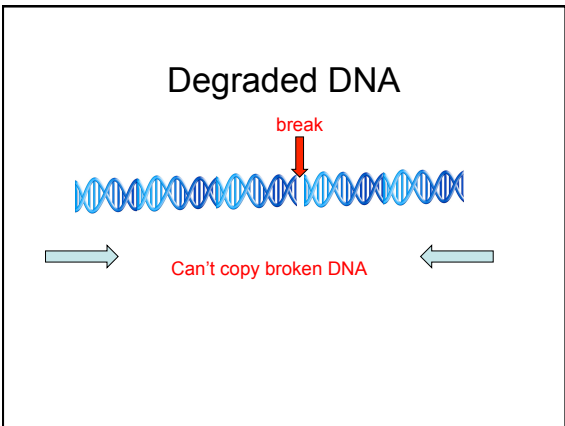
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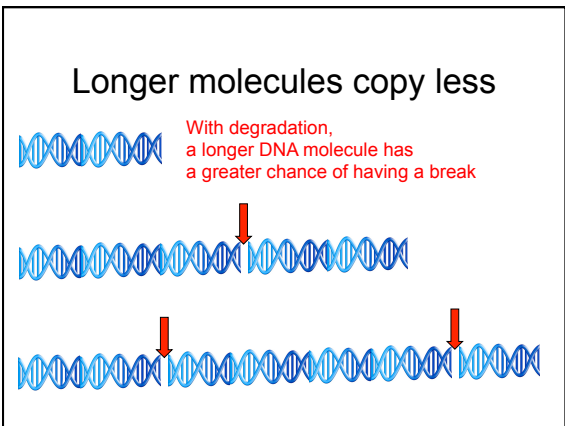
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## Break density & copy probability

*the break density*

$p = \text{Pr}(\text{break at a nucleotide})$

$q = \text{Pr}(\text{no break at a nucleotide})$   
 $= 1 - p$

$q^n = \text{Pr}(\text{no break in } n \text{ nucleotides})$   
*the copy probability*

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## Decay factor $\lambda$

$$q = e^{\ln q} = e^{-\lambda}$$

break density			$q^n = e^{-\lambda n}$ copy probability			$n_{1/2}$
p	q	$\lambda$	100	200	400	
.000	1.000	.000	1.000	1.000	1.000	$\infty$
.001	.999	.001	.904	.819	.670	693
.002	.998	.002	.819	.670	.450	346
.005	.995	.005	.606	.367	.135	138
.010	.990	.010	.366	.134	.018	69

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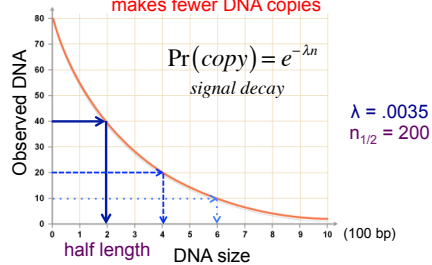
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## DNA decay curve

With degradation,  
 a longer DNA molecule  
 makes fewer DNA copies




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## Reduced match information

Degraded DNA  
↓  
Lower peak height  
↓  
Greater data variation  
↓  
More genotype uncertainty  
↓  
Diffused genotype probability  
↓  
Reduced match information

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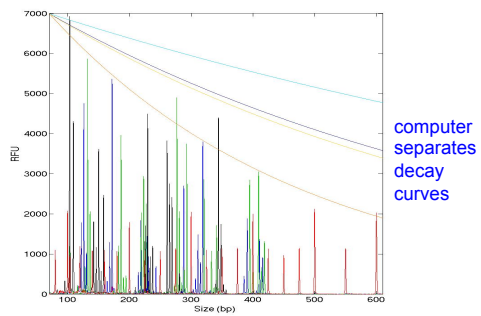
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## Differential mixture degradation



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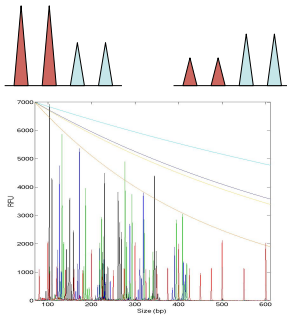
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## Affects mixture weight, genotypes



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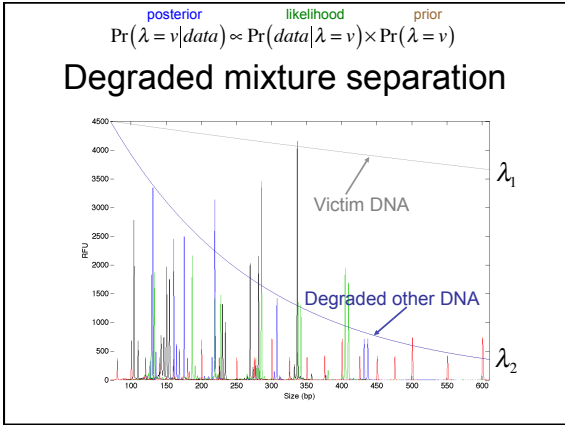
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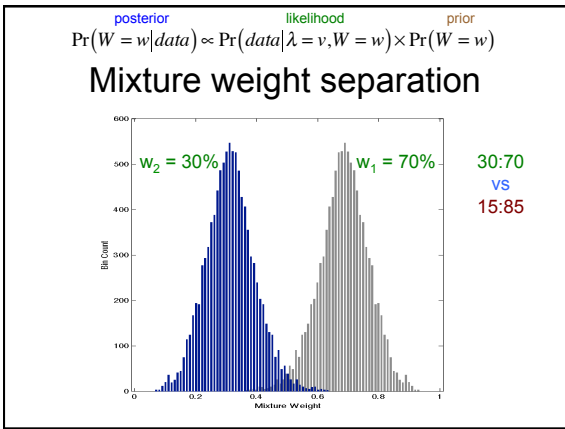
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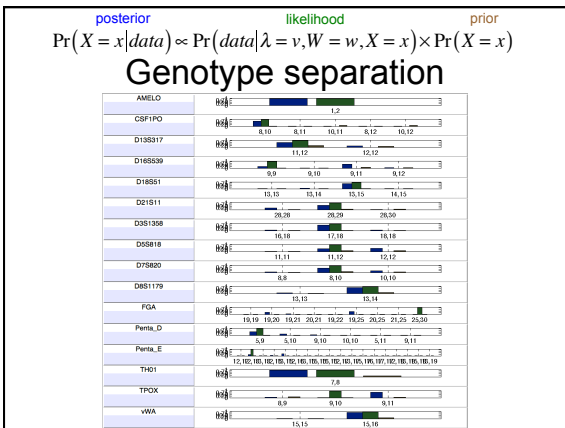
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## Information comparison

Combined probability of inclusion of **42 thousand**.  
(Human review with thresholds)

A match between the suspect and the evidence  
is a **billion** times more probable than coincidence.  
(TrueAllele **not** solving for degradation)

A match between the suspect and the evidence  
is a **trillion** times more probable than coincidence.  
(TrueAllele solving for degradation)

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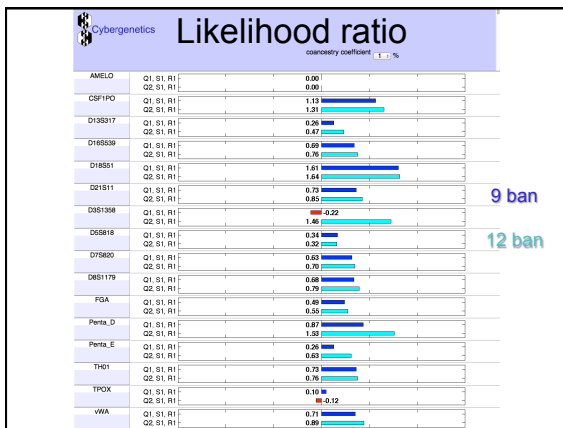
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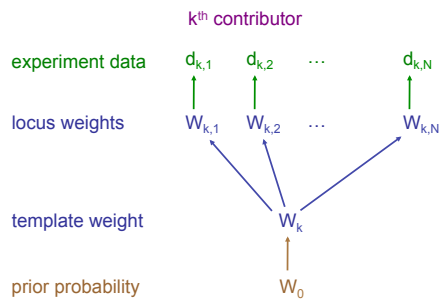
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## Hierarchical mixture modeling




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**READING EAGLE**

Originally Published: 11/2/2013

**Pa. Supreme Court upholds death sentence for man who stabbed lover 30 times**

Reading Eagle [Like](#) [Share](#) Sign Up to see what your friends like.

The state Supreme Court has upheld the death sentence for convicted murderer Glenn Lyons, ruling there was sufficient evidence of torture in the 2008 stabbing death of his lover, Kathy A. Leibig.

In a 29-page ruling, the high court said the death sentence was not due to passion or prejudice, but was the result of the jury's determination that Lyons stabbed Leibig 30 times over a 15-minute period and left her to bleed to death in the back seat of her car.

Lyons, now 47, of Reading had met Leibig of Millcreek Township, Lebanon County, in 2007 while both were employed by Linette Quality Chocolates, Heidelberg Township. They had an affair, but police said that ended on May 1, 2008, when Lyons killed Leibig, 45.



Reading Eagle: Tim Leedy

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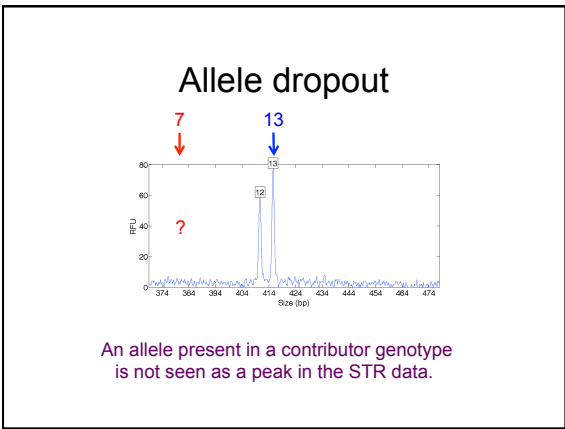
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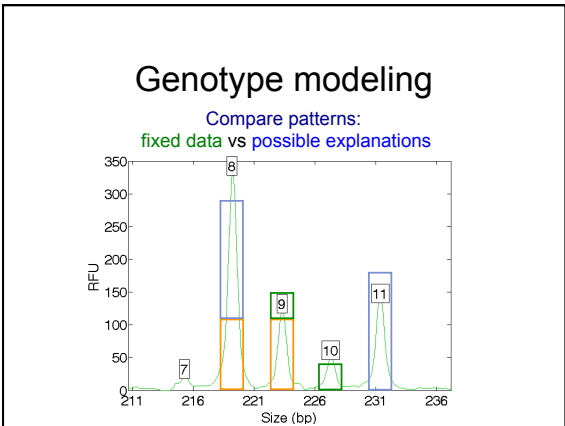
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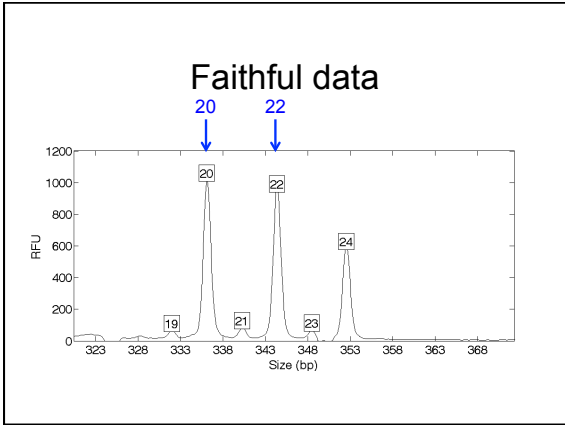
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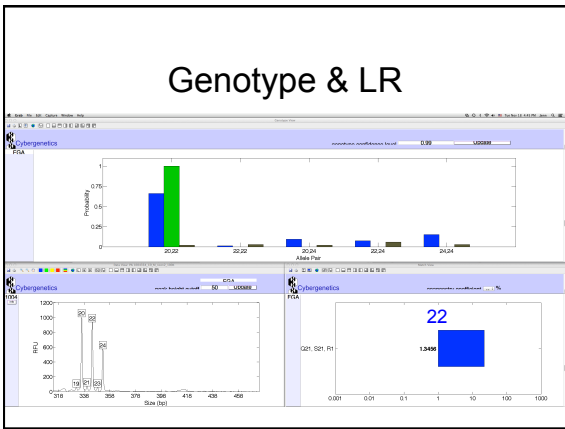
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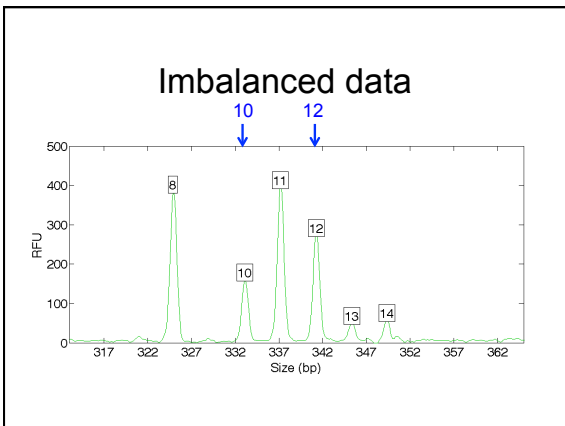
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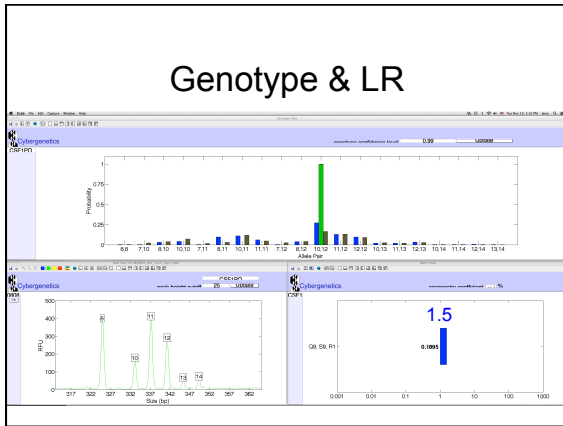
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## Genotype & LR




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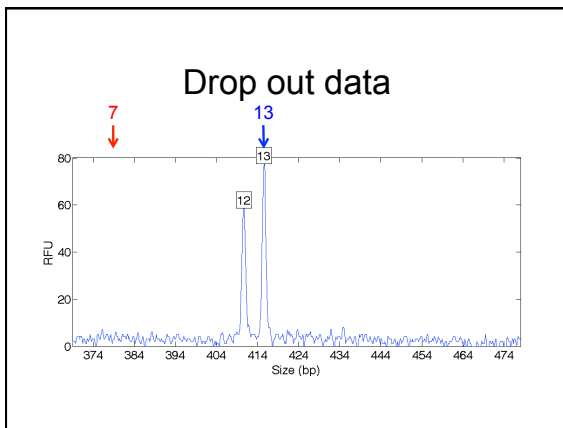
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## Drop out data




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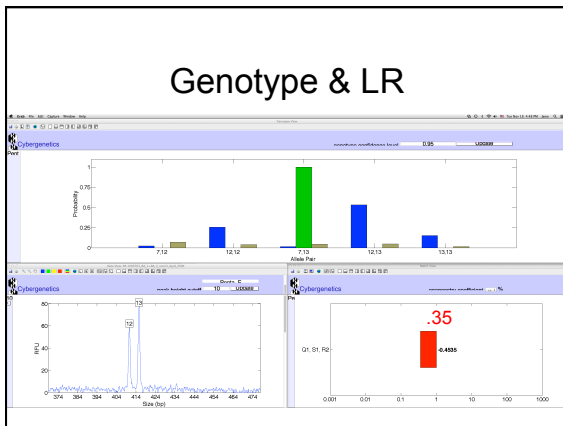
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## Genotype & LR




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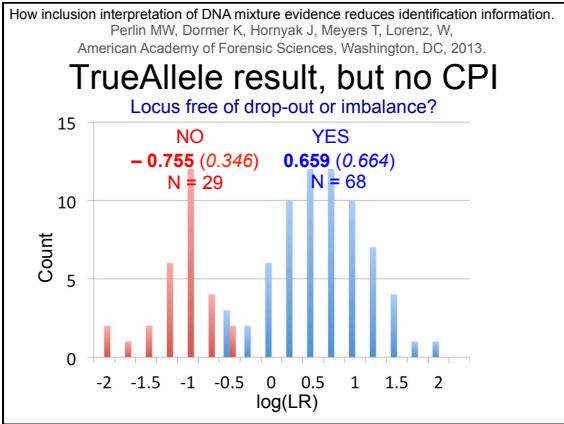
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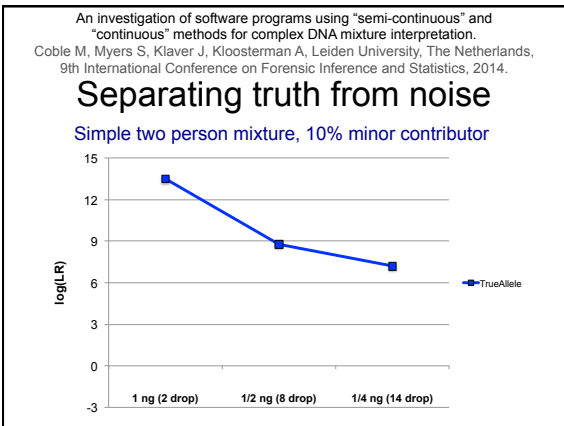
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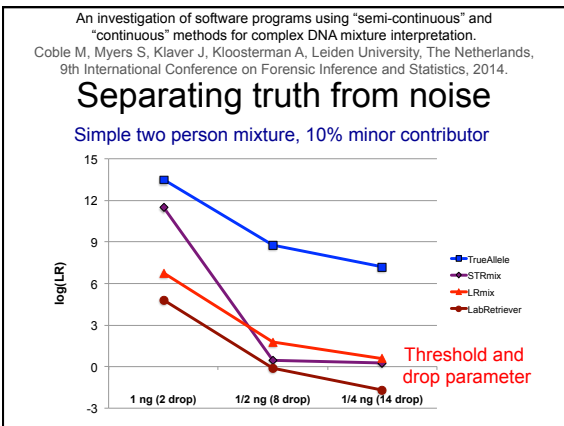
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## How TrueAllele Works

Part 1, 16-Oct-2014  
Genotype modeling and the likelihood ratio

Part 2, 20-Nov-2014  
Degraded DNA and allele dropout

Part 3, 18-Dec-2014  
Kinship, paternity and missing persons

<http://www.cybgen.com/information/webinar/page.shtml>



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perlin@cybgen.com

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