

News

NEWS ALERT!!! (April 15, 2003) (from Gene and the editors)

Researchers complete sequencing of human genetic code and it is 99.99 % accurate! An achievement once thought impossible. A new era in medicine is beginning, which we hope will bring cures to many devastating illnesses.

VITAMIN C TRANSFORMS MOUSE STEM CELLS INTO HEART MUSCLE CELLS

Source: American Heart Association

Researchers at Harvard Medical School and Brigham and Women's Hospital in Boston were able to convert mouse embryonic stem cells to heart muscle cells by adding vitamin C. Their work is published in the rapid track publication of *Circulation: Journal of the American Heart Association*.

Embryonic stem cells are found in the very early stages of fetal development and, in suitable environment, can differentiate into any type of cell in the body.

Dr. Richard T. Lee and his colleagues tested 880 bioactive substances approved by the FDA, on their ability to transform the mouse stem cells into heart muscle cells. The stem cells were inserted with a gene that would fluoresce bright green if the cell changed into a heart muscle cell. After adding vitamin C to the cells, the scientists found green glow in these cells. They also found that both cardiac myosin and actin (proteins involved in relaxing and contracting muscle) were present in the vitamin C-treated cells.

Although the work is preliminary, the ability to grow or implant new heart muscle could save or improve the quality of life for many people who suffer from heart failure.

Biographies of the Notables in Science

In this newsletter, we will feature the notable **Frederick Sanger**



Frederick Sanger was born on August 13, 1918, at Rendcombe in Gloucestershire, England. He received his B.A. degree in natural sciences in 1939. Since 1940 he has carried out research in the Department of Biochemistry at Cambridge. Between 1940 and 1943 he worked with Dr. A. Neuberger on the metabolism of the amino acid lysine and obtained a Ph.D. degree. He developed a method for amino acid sequencing which helped him deduce the sequence of the protein **insulin** for which he was awarded the Nobel Prize for Chemistry in 1958. From 1944 to 1951 he held a Beit Memorial Fellowship for Medical Research and since 1951 he has been a member of the External Staff of the Medical Research Council (MRC) Laboratory of Molecular Biology in Cambridge.

He became interested in nucleic acids and developed the chain termination method of sequencing for which he was awarded a second Nobel Prize in Chemistry in 1980, along with Paul Berg and Walter Gilbert.

He is currently the Head of the Division of Protein Chemistry at MRC. He is married to Margaret Joan Howe; they have two sons and one daughter. His hobbies include gardening and what he calls "messing about in boats."

Hands-on Activity

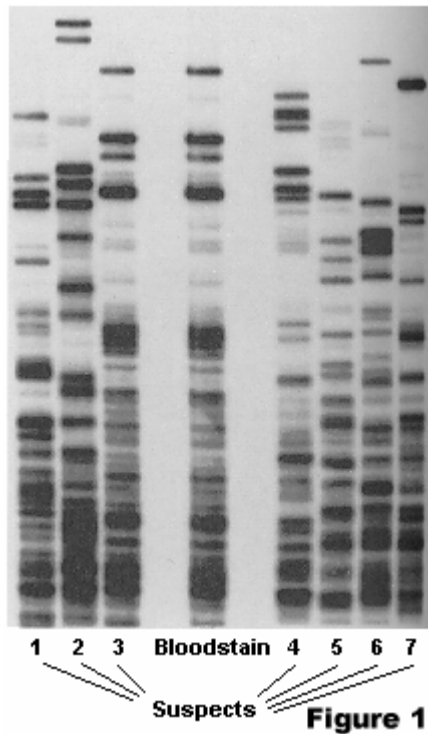
Forensic Cases

In this issue, three forensic cases will be presented.

In Case 1, students will learn how VNTR (Variable Number Tandem Repeat) analysis is used in a forensic case. VNTR is defined by Rudin and Inman as "'Repeating units of an identical (or similar) DNA sequence, arranged in direct succession in a particular region of a chromosome, for which the number varies between individuals.'" In Case 2, students will learn how blood typing is used in a forensic case. In Case 3, students will learn how mtDNA helps forensic scientists determine the identity of a person.

Case 1

Seven men and women were identified by eyewitnesses as possible suspects in a robbery of an ancient artifact in a Manhattan museum. The encased glass where the valuable piece was on display was broken. Investigators found a bloodstain on a piece of the shattered glass. Blood samples were drawn from all of the suspects and typed using VNTR analysis. The resulting picture (Figure 1) was from the laboratory where the samples were tested. It shows a wide range of fragment sizes from high molecular weight (about 14 kb) to small molecular weight (about several hundreds).



Questions 1-3 are related to Figure 1.

1. What type of DNA testing method is the above VNTR autorad?

Answer: RFLP or restriction fragment length polymorphism. The blot shows a wide range of fragment sizes from high molecular weight (about 14 kb) to small molecular weight (about several hundreds).

2. What types of samples are missing from this autorad?

Answer: Controls and molecular weight ladder. Controls are very crucial in any experiment. They are used for the purpose of comparing unknown samples with known samples. Molecular weight ladders determine the size of the fragments.

3. Which suspect's DNA matched the bloodstain? Why?

Answer: Suspect 3. Every band matched the evidence sample.

Case 2

A wealthy woman died and left her large estate to her estranged son. Two men showed up at the estate claiming to be the mother's son (neither of them remembers who the father was). Blood was drawn from both men and serology testing was performed and compared to the mother's blood. The woman was married and then divorced her husband before her son was born. Investigators were able to track her ex-husband. Blood was drawn from him too.

The following are the serology results.

	ABO type
Ex-husband	O
Mother	AB
Man # 1	A
Man # 2	B

Questions 1 through 3 are related to the above table.

1. Can you determine who is the woman's son from the above information?

Answer: No. Either man can be the son. See Punnett Squares below.

	O	O
A	AO	AO
B	BO	BO

AO is A blood type and BO is B blood type

2. If no conclusion can be drawn from the above data, what other analysis may determine who the son is?

Answer: Mitochondrial DNA and or/other DNA analysis.

3. How many people in a population of 530,000 would have the blood type as the mother? Use the table below to answer the question.

O	A	B	AB
43%	42%	12%	3%

The above Table is taken from "Criminalistics- An Introduction To Forensic Science"- by Richard Saferstein. 7th Edition.

Answer: 227,900.

Case 3.

The following is based on historical facts taken from TIME.com, May 1, 2000, Vol.155, No.18, Science by Nadya Labj.

During the French Revolution, King Louis XVI and Queen Marie Antoinette were imprisoned along with their young son Prince Louis XVII. After his parents' execution, the prince was left in prison to die. Some people thought that the king's supporters rescued the prince and left an imposter in his place.

Centuries later, DNA from the heart of the mummified body of the "imposter" was analyzed and compared to DNA taken from the heir of Marie Antoinette and two of her sisters. In addition, DNA was taken from living maternal relatives of the queen for further confirmation. Forensic scientists did the DNA analysis and the result showed that the "imposter" was indeed Prince Louis XVII, thus ending suspicions about the young prince's short life.

Questions 1 through 5 are based upon this case.

1. What part of the cell was the DNA extracted from?

Answer: Mitochondrial DNA.

2. What type of method was done to do the analysis?

Answer: DNA sequencing.

The following is a piece of the hypervariable (D-loop) region where the DNA was analyzed.

“Imposter”- sequence (1):

```
1 tgcacgaata aattccttcc taatttttcg atttztatgc tatgtcagta ttaaattttt
61 tttgtaaaaa gaattttttt ttctaaaagt atattacatt ataataatgt tataagacat
```

Marie Antoinette’s sister- sequence (2)

```
1 tgcacgaata aattccttcc taatttttcg atttztatgc tatgtcagta ttaaattttt
61 tttgtaaaaa gaattttttt ttctaaaagt atattacatt ataataatgt tataagacat
```

Marie Antoinette’s maternal relative 1- sequence (3)

```
1 tgcacgaata aattccttcg taatttttcg atttztatgc tatgtcagta ttaaattttt
61 tttgtaaaaa gaattatttt ttctaacagt atattacaat ataataatgt tataagacat
```

Marie Antoinette’s maternal relative 2- sequence (4)

```
1 tgcacgaata aattccttcc taatttttcg atttztatgc tatgtcagta ttaaattttt
61 tttgtaaaaa gaattttttt ttctaaaagt atattacatt ataataatgt tataagacat
```

3. Whose DNA(s) did the “imposter’s” DNA match? Explain.

Answer: Sequence 2 and sequence 4. Both sequences are identical to sequence 1.

4. Whose DNA(s) did the “imposter’s” DNA not match? Why?

Answer: Marie Antoinette’s maternal relative 1- sequence 3. There are about 5 base-pair variations in the sequence as compared to the sequence of the “Imposter”. [Related by marriage and not by blood. For example, Marie Antoinette’s uncle, her mother’s brother- married a woman with this sequence (3). Her offspring will have the same sequence (3)].

5. If you have a sequence: 3’- acgttacccaagtgcataccaatgacattccggact – 5’, what would the complementary (opposite) strand be? (New DNA strand is read from 5’ to 3’ direction).

Answer: 5’-tgcaatcgggtcacgtatggttactgaaggcctga-3’

Humor

An anecdote to lift your spirits up is essential! So, here is one—you are encouraged to laugh loudly so that others can hear it too!

<http://home.attbi.com/~wildlifebio/Jokes.htm#JOKES%20LIST>

After weeks of searching, an unemployed biologist gets an interview at a local zoo. The only job available is to dress up in a gorilla's skin and pretend to be a gorilla so people will keep coming to the zoo.

On his first day on the job, the poor biologist puts on the skin and goes into the cage designated for gorillas. The people all cheer the new gorilla. After a while, the biologist starts really putting on a show, jumping around, beating his chest and hollering like a gorilla.

Unfortunately, during one acrobatic attempt, he loses his balance and crashes through some safety netting, landing square in the middle of the lion cage. As he lies there stunned, the lion rushes toward him, roaring and snarling. The biologist is terrified and screams, "Help, Help....someone help me!!!!"

As the biologist gets up and tries to run away, the lion races over to him, knocks him to the ground, and quietly whispers "Hey it's me Sam, from your mammal class, shut up or we'll both lose our jobs!"
