Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Period\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

[](http://www.google.com/url?sa=i&rct=j&q=fred%20and%20wilma%20flintstone&source=images&cd=&cad=rja&docid=-WwwXeQSti2aDM&tbnid=h2JI8RbXYnO6NM:&ved=0CAUQjRw&url=http://www.amworkout.com/becoming-fred-and-wilma-flintstone/&ei=kl77UvbnEqTgyQHPlYCABg&bvm=bv.61190604,d.aWc&psig=AFQjCNG50q6SJNt1mFpiSriT1Lip_ePdpQ&ust=1392291808706586)

***The Secrets of Bedrock***

***Sex-linked Traits with Fred and Wilma***

# Background

Geneticists have succeeded in sequencing the genes on the sex chromosomes of Bedrock’s most famous couple, Fred and Wilma Flintstone. Shocking discoveries have been made - the secrets of Bedrock can now be revealed.

# Part I: Flintstone Family Secret Analysis:

Use the data for Fred & Wilma’s sex chromosome in the tables below to answer questions 1-15 in the spaces provided.

## Traits on the X chromosome (in the order they appear from top to bottom)

|  |  |
| --- | --- |
| **Dominant** | **Recessive** |
| O – predisposed to obesity | o – not predisposed to obesity |
| N – Normal vision (can see red and green) | n – red-green colorblindness |
| B – Normal hair growth | b – baldness |
| H – Normal blood clotting | h- hemophilia (blood does not clot) |
| D – Normal hearing | d – deafness |
| P – Pigmented eyes (brown, blue, or green) | p – red eyes (no pigment) |
| E – Faulty tooth enamel | e – normal tooth enamel |
| S – Sweat glands present | s – sweat glands absent |
| M – Not predisposed to migraines | m – predisposition to migraines |

## Trait on the Y chromosome

|  |  |
| --- | --- |
| **Dominant** | **Recessive** |
| H – hair growth in ears absent | h- hair growth in ears present |

1. Use the genotype for Fred and Wilma to figure out their phenotype. Write each phenotype in the space provided in the table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **X-Linked Traits** |  |  |  |  |
| **Trait** | **Fred’s Genotype** | **Fred’s Phenotype** | **Wilma’s Genotype** | **Wilma’s Phenotype** |
| Obesity | **XOY** | **Obesity** | **XoXo** | **No obesity** |
| Color Vision | **XnY** |  | **XNXn** |  |
| Hair Growth | **XBY** |  | **XbXb** |  |
| Blood Clotting | **XHY** |  | **XHXh** |  |
| Hearing | **XDY** |  | **XdXd** |  |
| Eye Pigment | **XpY** |  | **XPXp** |  |
| Tooth Enamel | **XEY** |  | **XeXe** |  |
| Sweat Glands | **XsY** |  | **XSXs** |  |
| Migraines | **XmY** |  | **XMXM** |  |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Y-Linked Traits** |  |  |  |  |
| **Trait** | **Fred’s Genotype** | **Fred’s Phenotype** | **Wilma’s Genotype** | **Wilma’s Phenotype** |
| Ear Hair | **X Yh** |  | **XX** |  |

1. Can Wilma tell the difference between red and green Christmas lights? \_\_\_\_\_\_\_\_\_ (YES or NO). Wilma’s genotype \_\_\_\_\_\_\_\_\_\_ **Explain**
2. Does Wilma have faulty tooth enamel? \_\_\_\_\_\_\_\_\_ (YES or NO). Wilma’s genotype \_\_\_\_\_\_\_\_ **Explain**.
3. Do you think Wilma has to get her hair cut & colored often? \_\_\_\_\_\_\_\_\_ (YES or NO). Wilma’s genotype \_\_\_\_\_\_\_\_ **Explain**.
4. Are there traits for which Wilma is a **carrier**? **If so, list all of them or explain why not.**
5. Are there traits for which Fred is a **carrier**? **If so, list all of them or explain why not.**
6. Is Fred lying when he tells Wilma that he thinks her hair is a gorgeous shade of red? \_\_\_\_\_\_\_\_\_ (YES or NO). **Explain using 2 pieces of genetic information**.
7. A dedicated pet owner, Fred walks Dino once a day, but has a hard time **cooling** his body down. Explain why this is true. (hint: what feature helps people lose heat when they are exercising).

[](http://www.google.com/url?sa=i&rct=j&q=fred%20flintsone%20walking%20dino&source=images&cd=&cad=rja&docid=O_CSb_jzchsidM&tbnid=dGRuh5AhHTmW-M:&ved=0CAUQjRw&url=http://www.answers.com/topic/dino-the-flintstones&ei=Q2L7UsnPOcGbygGq-YCwCQ&bvm=bv.61190604,d.aWc&psig=AFQjCNFYNdIDcxmvwggto8E7LzzfXoz-aQ&ust=1392292802154909)

Fred’s genotype \_\_\_\_\_\_\_\_\_\_\_\_

1. Does Fred need to wear a toupee (which is a wig for a man)? \_\_\_\_\_\_\_\_\_ (YES or NO). **Explain**.

Fred’s genotype \_\_\_\_\_\_\_\_\_\_

1. Does Pebbles (their **daughter**) need to be treated for faulty tooth enamel? Set up a Punnett square to show your answer. **Answer YES or NO and circle the possible genotypes of Pebbles** in the Punnett Square.

[](http://www.google.com/url?sa=i&rct=j&q=flintstones&source=images&cd=&cad=rja&docid=-G8e4J1KfUQHgM&tbnid=ryKSYIZjgyM5AM:&ved=0CAUQjRw&url=http://www.boomerangtv.co.uk/shows/the-flintstones/characters/pebbles-flintstone&ei=s137UuCTIsqCyQHC5oA4&bvm=bv.61190604,d.aWc&psig=AFQjCNH5crAEO4oW5KPrl43Pe-chC8jp8g&ust=1392291619073556)

|  |  |
| --- | --- |
|  |  |
|  |  |

1. Would Pebbles need to wear a wig? Set up a Punnett square to illustrate your answer? \_\_\_\_\_\_\_ **Answer YES or NO and circle the possible genotypes of Pebbles** in the Punnett Square.

|  |  |
| --- | --- |
|  |  |
|  |  |

1. What percent chance does Pebbles have to be predisposed to obesity? \_\_\_\_\_\_\_ Show work.

|  |  |
| --- | --- |
|  |  |
|  |  |

1. If Fred and Wilma had a **son**, what are his chances of having normal vision? \_\_\_\_\_\_\_ Show work.

|  |  |
| --- | --- |
|  |  |
|  |  |

1. Does Wilma get angry when Fred screams…”WILMAAAAAAAAAA”? **Explain**.
2. What chance does Pebbles have to develop hairy ears? **Explain**.

**Part II: Family or Fraud?**

A young man named “BAM BAM” has just arrived in Bedrock, and he claims to be the son of one of the Flintstones!! Who fathered/mothered Bam Bam? It’s up to you to solve this mystery. Fortunately Bam Bam agreed to DNA sequencing and the results are now in.

[](http://www.google.com/url?sa=i&rct=j&q=flintsontes+bam+bam+and+dino&source=images&cd=&cad=rja&docid=JYiwt1K6jRNLlM&tbnid=YygP4maOkVeaEM:&ved=0CAUQjRw&url=http://www.tvbanter.net/2011/02/flintstones-quiz.html&ei=q2D7UoueDqSRygGetoCoDw&bvm=bv.61190604,d.aWc&psig=AFQjCNHXr31v8eebDkXmlkC_tXFx87PxzA&ust=1392292347006535)

**Procedures:**

Use Bam Bam’s X and Y chromosomes to answer the following questions.

1. Fill in Bam Bam’s genotype for each sex-linked trait in the table below.

|  |  |  |
| --- | --- | --- |
| Trait | Bam Bam’s Genotype | Bam Bam’s Phenotype |
| Obesity | **XoY** | **No obesity** |
| Color Vision | **XnY** |  |
| Hair Growth | **XbY** |  |
| Blood Clotting | **XHY** |  |
| Hearing | **XDY** |  |
| Eye Pigment | **XpY** |  |
| Tooth Enamel | **XeY** |  |
| Sweat Glands | **XsY** |  |
| Migraines | **XmY** |  |
| Ear Hair | **X YH** |  |

1. Could **Fred** be the father of **Bam Bam**? Provide specific “**genetic evidence**” to support your answer.
2. Could **Wilma** be **Bam Bam’s** mother? Provide specific “**genetic evidence**” to support your answer.

**Concluding Questions:**

1. Which parent determines the gender of the child? \_\_\_\_\_\_\_\_\_\_\_\_\_\_ Explain why.
2. Why are males affected by recessive sex-linked diseases more often than females? Be specific
3. If a male has a disease that is Y-linked, what percentage of his sons will inherit the disease?

**Explain.**

1. If a male has a disease that is Y-linked, what percentage of his daughters will inherit the disease? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ What percentage will be carriers? \_\_\_\_\_\_\_\_\_\_\_\_\_ **Explain.**

What percentage of his sons will inherit the disease? \_\_\_\_\_\_\_\_\_\_\_ **Explain.**

8. Could a female ever exhibit (show) a sex-linked recessive trait? **Explain.**

9. What two things have to happen in order for a female to exhibit a sex-linked recessive trait?