



*Sponsored by the University of Colorado at Boulder*

## Pasta Genetics

### Mendelian Inheritance of Fanconi Anemia and HLA type

#### Acknowledgements

The technique used in this activity is based on Pasta Genetics, Developed by Megan Brown and Maureen Munn, The GENETICS Project, University of Washington. The activity itself is based on genotype information found in Verlinsky, V et al, 2001, Preimplantation Diagnosis for Fanconi Anemia Combined with HLA Matching, JAMA: 285, 3130-3133.

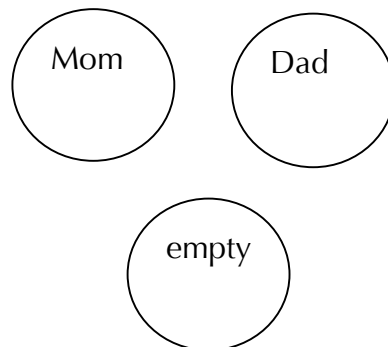
Note: the Nash family is not identified in the above paper, so although we discussing the case of the Nash family in today's workshop, the genotype information may not be that of the Nash family.

#### Introduction

In this activity you will use colored pasta to represent human chromosomes carrying the HLA type and FANCC genes. You will be given the pasta representing the parents and then be asked to create several possible embryos and determine whether any of them could be a suitable donor for the affected child.

#### Setup

You will receive two dishes of pasta, one dish represents the mother, the other the father. Arrange the dishes as shown below.



The spiral shaped pasta represents chromosome 6 that carries the HLA genes  
Red represents –HLA-B35, HLA-A1 (mom)  
Yellow represents – HLA-B44, HLA-A2 (mom)  
Green represents – HLA-B35, HLA-A26 (dad)  
Blue represents – HLAB41, HLA-A3 (dad)

The bowtie shaped pasta represents chromosome 9 that has the FANCC gene  
Yellow represents the normal allele  
Blue represents the ivs4+4 mutant allele  
Each parent has one of each

### **Questions**

The affected child's HLA type is HLA-B44, HLA-A2; HLA-B35, HLA-A26.

The affected child has FA.

What colors and shapes of pasta would represent the child's chromosomes 6 and 9?

What colors and shapes of pasta would represent chromosomes 6 and 9 of an HLA matched donor without FA? (Note: list all possible combinations that would be FA-free and an HLA match).

### **Procedure**

Remember that in meiosis, one copy of chromosome 6 and one copy of chromosome 9 are placed into each gamete. The gametes then unite to form a fertilized egg with two copies of chromosome 6 and two copies of chromosome 9, one from each parent.

You will now use the affected child's parents simulated DNA to generate simulated embryos.

1. Locate the dish representing the mom. Place your hand here. Close your eyes. Without looking, pick up one spiral shaped pasta and one bowtie pasta and put it in the dish representing the embryo.
2. Then locate the dish representing the dad. Without looking, pick out one spiral shaped pasta and one bowtie pasta and put it in the dish representing the embryo.

**Results**

Note the colors and shapes of the pasta in the table below. Then note the HLA type and FA status of your embryo in the table. Replace the noodles in their original dishes (see pg 1 if needed), close your eyes, and repeat the process 2 more times.

Embryo	Colors of spiral pasta	Colors of bowtie pasta	HLA type	FA status (will have FA, carrier, normal)
1				
2				
3				

**Questions**

Would any of the embryos you created be FA-free and be an HLA-match for the affected child?

Would any any of the embryos you created have FA?

**Out of the whole class**

How many embryos were generated?

How many were FA free and an HLA type match for the affected child?

In the classroom, what fraction of embryos was a suitable match?

How does this number compare with the expected frequency ( $3/16$ ) you generated in the last activity?

In the case presented today, 41 embryos were created by in vitro fertilization and tested by preimplantation genetic testing. 8 of these embryos were FA-free and an HLA match for the affected child. 7 of these embryos were implanted (5 separate attempts). One of them resulted in the birth of a second child whose cord blood was used to perform a successful bone marrow transplant on the affected child.

How does the frequency of FA-free HLA-matched possible donor embryos compare with the expected frequency?