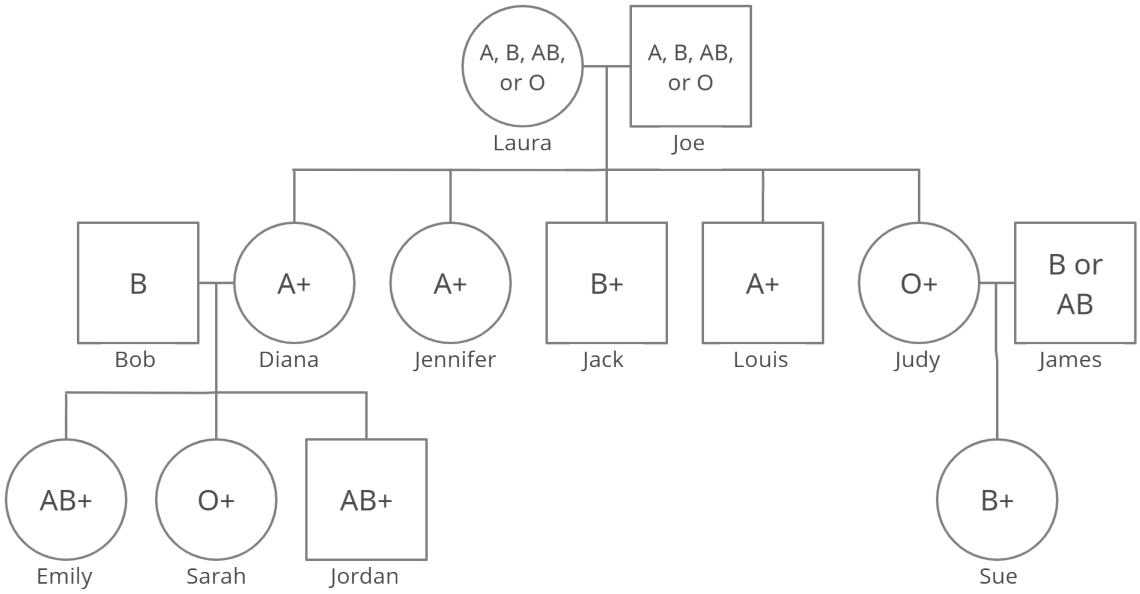
Finding a Match

Key: I^A = A; I^B = B; i = O

- **Completion of data table #2 (step 5)**

Blood Sample	Agglutination with Anti-A Serum (+/-)	Agglutination with Anti-B Serum (+/-)	Agglutination with Anti-Rh Serum (+/-)	Blood Type	Possible Genotypes
Diana Jones	+	–	+	A+	I^AI^A or I^Ai
Jennifer	+	–	+	A+	I^AI^A or I^Ai
Jack	–	+	+	B+	I^BI^B or I^Bi
Louis	+	–	+	A+	I^AI^A or I^Ai
Judy Smith	–	–	+	O+	ii
Sue Smith	–	+	+	B+	I^BI^B or I^Bi
Emily Jones	+	+	+	AB+	I^AI^B
Sarah jones	–	–	+	O+	ii
Jordan Jones	+	+	+	AB+	I^AI^B

- **Pedigree (steps 6-7)**

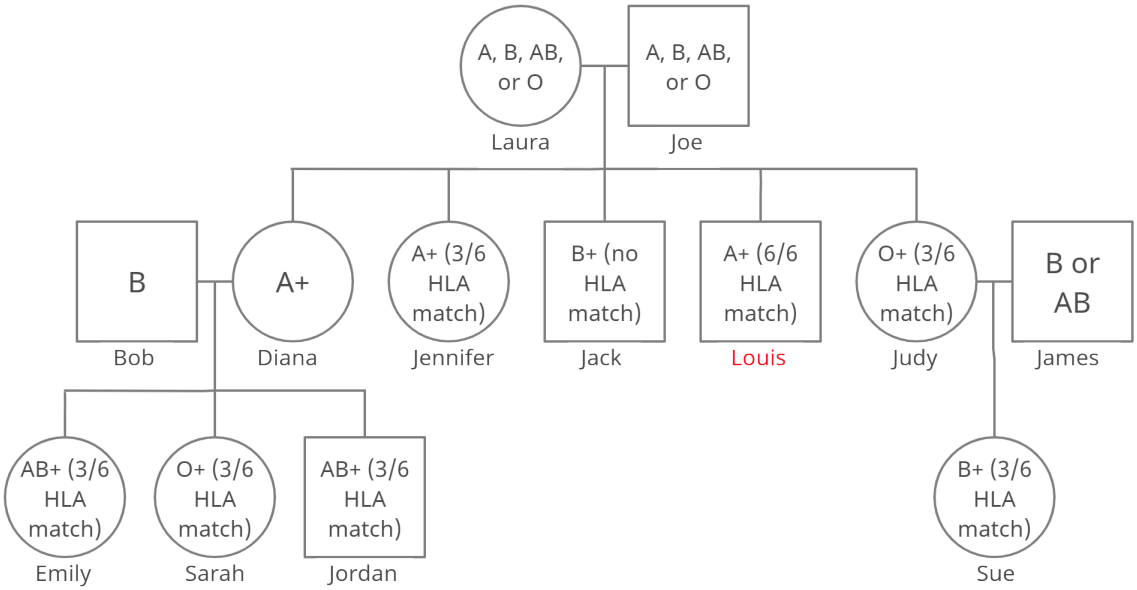


- **Identification of donors (step 11)**

Diana	**Jennifer**	**Louis**	**Judy**	**Sarah**
A2	A1	A2	A2	A2
A10	A10	A10	A6	A1
B7	B3	B7	B7	B7
B16	B16	B16	B9	B8
DR11	DR35	DR11	DR11	DR11
DR8	DR8	DR8	DR4	DR20

Based purely off of blood typing I determined that good potential donors would be Jennifer, Louis, Judy, and Sarah. However, after the HLA typing test, I was able to further narrow it down. I compared the HLA antigens the family members had in common with Diana in the table above and found that Jennifer, Judy, and Sarah only had 3/6 antigens in common with Diana. But, Louis had all 6 HLA antigens in common with Diana, thus I came to the conclusion that Louis was the closest match and therefore the most appropriate match to be her kidney donor.

- **Updated pedigree (step 12)**



- **Conclusion Questions 1-10**

1. Based on blood type alone, who can donate a kidney to Diana? Explain your reasoning.

   Based on blood type alone, those who can donate a kidney to Diana are Jennifer and Louis because they have blood type A like Diana, as well as Judy and Sarah because they have blood type O which makes them universal donors.

2. What were Diana's parents' blood types and their corresponding genotypes? Use your pedigree to help you determine their blood types and corresponding genotypes. Explain how you determined your answer.

   Out of Diana's mother, Laura, and her father, Joe, one must have had type AB and the other type O, or one have type A and the other have type B. This is because three of their kids have type A, one has type B, and one has type O. Because they were able to have kids of all of these blood types, that means that one parent had to have both the A and B allele, meaning they had to be type AB (I^AI^B), and one had to have type O blood meaning that they had the two alleles for type O (ii). OR one had to be type A with mixed alleles (I^AO) and the other had to be type B also with mixed alleles (I^BO).

3. Why is HLA typing necessary when matching up a kidney donor and recipient?

   HLA is responsible for stimulating the immune response to recognize tissue as self versus non-self, and this test is responsible for determining which HLA antigens are present. The test identifies the similarity of the antigens present in both the donor and recipient, and the closer the HLA antigens are of the transplanted organ to the recipient, the more likely the recipient will be to not reject the transplant. Thus, to make sure that the transplant will likely work and that the recipient will not die from rejection of the organ, this testing is needed before the operation is done.

4. Why is there a 25 percent chance of a six-antigen match between siblings?

   There are 6 HLA antigens and each person has two of those antigens. One allele comes from the mom while the other comes from the father. Thus there is a 50% chance that you will have the same allele from your mother and a 50% chance that you will have the same allele from your father. Thus, altogether, there would be a 25% chance that siblings would match all six antigens given the alleles from both their mother and father.

5. Why is a patient with a 25 percent PRA less likely to reject a kidney transplant than a patient with a 90 percent PRA?

   PRA stands for percent reactive antibody meaning that the higher the number is, the higher the chance is that the recipient of the transplant is to react against it and reject the organ. Therefore the lower the PRA value, the less likely the recipient is to reject the kidney, meaning that the person with the 25% PRA is less likely to reject the kidney than the person with the 90% PRA.

6. How is a cross-matching test similar to a blood typing test?

   A cross-matching test is similar to a blood typing test as they both test samples of blood from two different people to determine their compatibility. The tests look at the antibodies within the blood to determine if they will have a bad reaction when mixed. However, blood typing mainly looks at the anti-A and anti-B antibodies while cross-matching looks at many other, less major, antibodies that may still cause some reaction and possible rejection of blood/ an organ in the recipient's body.

7. How can marker analysis determine which HLA alleles are present? Hint: Refer back to Activity 3.2.3.

   Marker analysis works similarly to gel electrophoresis as DNA fragments are separated based on size with larger DNA fragments travelling a shorter distance and smaller DNA fragments travelling much farther. The genetic markers used in this process are short DNA sequences called STRs, which are regions of DNA composed of short sequences of repeated nucleotides. Alternate forms of these STRs correspond with different alleles, and we can used the STRs to differentiate between the different alleles. Therefore, we can use this to identify the presence of different HLA alleles.

8. Based on blood typing and HLA typing results, who is the most suitable match for Diana? Explain your answer.

   The most suitable match for Diana is Louis. From the blood typing test we determined that both Diana's and Louis' blood is type A+. This is because both of their blood samples experienced agglutination with the anti-A serum, meaning that they have the A antigen present in their blood. They also both have the Rh factor. Because we know they were compatible on this level, we then needed to run the HLA typing to determine whether they are totally compatible or if there is

still risk of reaction despite them being the same blood type. After running this test we determined that they had all 6 of the same HLA antigens, thus their PRA was 0%, making them compatible for a transplant. From these two tests we were able to determine the compatibility of the bloods of Diana and Louis and determined that it would be highly unlikely for Diana to reject the kidney that Louis may donate.

9. Now that you have determined a suitable match for Diana, what are the next steps? Why are these steps so important?

   The next steps are to continue toward the kidney transplant by ensuring that the blood match stays compatible over time until the date of the surgery. Components of the blood can change over time including the HLA antibodies and thus the PRA. Therefore, to ensure that Diana will not react to the transplant and reject the organ, both her and her donor, Louis, will need to undergo a serum crossmatch test multiple times until right before the surgery. This is very important to make sure that the surgery will still be successful even after the original blood typing and HLA typing tests.

10. Based on the results of the blood typing, HLA typing, and PRA (if calculated), who is the most appropriate family member to donate his or her kidney to Diana? Explain your answer. What additional test needs to be completed before the transplantation?

    Louis is the most appropriate family member to donate his kidney to Diana because, as mentioned in question 8, they have the same blood type of A+, match with all six HLA antigens, and have a 0% PRA. This was determined based on the blood typing and HLA typing tests. Leading up to the transplantation, Diana and Louis both need to undergo serum crossmatch tests to ensure that the components of the blood, including the HLA antigens, do not change over time, and to make sure that the PRA value does not increase. This will make sure that the transplantation is safe and will likely work long after the initial blood typing and HLA typing tests.