



Kidney Donor

The Case:

Your patient is a 20-year old woman who is experiencing kidney failure. She needs a kidney transplant. Three of the patient's relatives, her mother ("Donor X"), her younger brother ("Donor Y"), and her grandmother ("Donor Z") are willing to donate one of their kidneys to her. This type of "living donor" kidney donation is possible because a healthy person can live with only one kidney.

There are three major concerns that need to be addressed in selecting the person who can donate a kidney to a patient:

- The condition of potential donors' kidneys
- The compatibility of the patient's and potential donors' blood and tissue types
- The potential donors' health and chances for surviving the removal of one kidney

Your Task:

Conduct clinical laboratory tests and evaluate data to determine which of the relatives (Donor X, Donor Y, or Donor Z) could safely donate a kidney to the patient. **As you work, be certain to record the results of your testing.**

CLINICAL LABORATORY TEST 1:
Urinalysis: Evaluate the Condition of Potential Donor's Kidneys

Urinalysis involves a number of tests to measure the concentrations of various substances present in the urine. If the level of any of these is not normal, it could indicate that the person may have kidney disease. Urinalysis test strips contain indicators that change color when they come in contact with specific substances in urine.

1. Test the urine from the patient and the three potential kidney donors (Donors X, Y, and Z) by following the directions in the bag of urinalysis test strips. Record the results of your tests in the table below.

Urinalysis Results Tests				
	Ketones	Blood	Protein	Glucose
Patient				
Donor X				
Donor Y				
Donor Z				

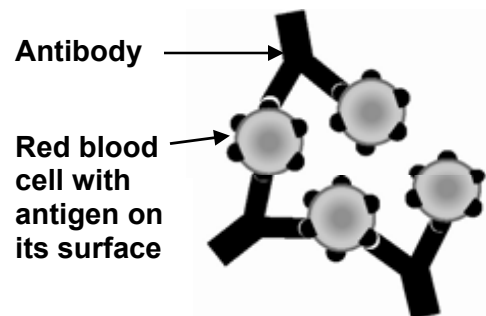
2. Based on the **urinalysis test results only**, which relatives (Donor X, Y, and/or Z) would you conclude should not be a kidney transplant donor? _____

Support your conclusion with evidence from the urine testing data.

3. Explain why it might be dangerous for this donor to provide a kidney for the patient.

**CLINICAL LABORATORY TEST 2:
Blood Typing: Evaluate the Compatibility of the Donor's and Patients' Blood**

A dangerous reaction may occur if incompatible blood types are mixed. Antigens on the surface of the donor red blood cells may cause the recipients (patient's) immune system to produce antibodies against the donor's blood. When the patient's antibodies react with antigens on the donor's red blood cells, dangerous clumps form and block the patient's blood vessels.



1. Test the blood from the recipient (the patient) and three potential kidney donors (X, Y, and Z) by following the directions on the bag labeled "Blood Typing Kit." Record the results in the table below.

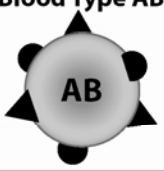
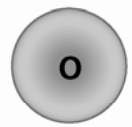
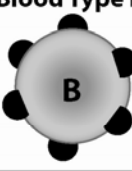
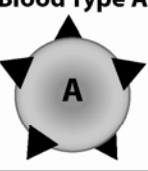
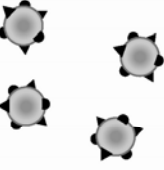
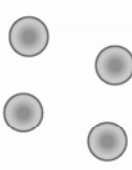
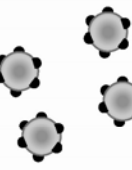
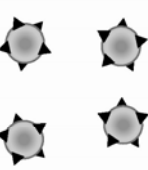

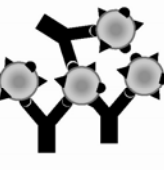
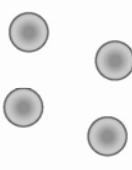
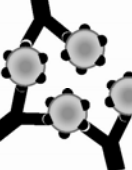

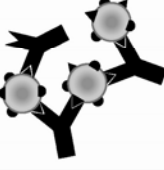
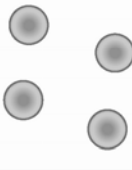
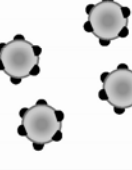
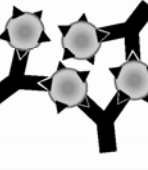


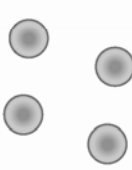

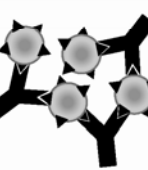
Results of Blood Typing

Blood Sample from:	Observations (clumped or not clumped)		Blood Type A, B, AB, or O (Use the information in the Antibody Testing Reactions table)
	Antibody A	Antibody B	
Patient			
Donor X			
Donor Y			
Donor Z			

2. Use the information in the following table to interpret the results of the blood type testing.

Antibody Testing Reactions		
Antibody Solution A	Antibody Solution B	Blood Type
Clumped	Not clumped	A
Not clumped	Clumped	B
Clumped	Clumped	AB
Not clumped	Not clumped	O

Reactions When Donor Red Blood Cells Are Mixed With Recipient Antibodies

		DONOR RED BLOOD CELLS			
		Blood Type AB	Blood Type O	Blood Type B	Blood Type A
RECIPIENT (PATIENT) ANTIBODIES	Blood Type AB				
	no antibodies to A or B				
	SAFE	SAFE	SAFE	SAFE	
	Blood Type A				
Anti B antibodies	DANGEROUS	SAFE	DANGEROUS	SAFE	
Blood Type B					
Anti A antibodies	DANGEROUS	SAFE	SAFE	DANGEROUS	
Blood Type O					
Anti A + B antibodies	DANGEROUS	SAFE	DANGEROUS	DANGEROUS	

3. Based on the results of the **blood typing (and the information in the chart above) only**, which relatives (X, Y, and/or Z) would you conclude should not donate a kidney to the patient? _____

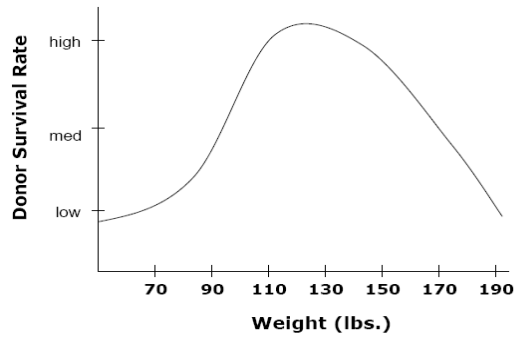
Support your conclusions with evidence from the blood typing data.

4. Explain why it might be dangerous for the patient, to receive a kidney from these donors.

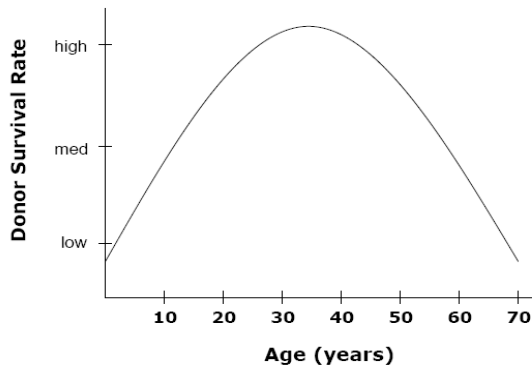
CLINICAL LABORATORY TEST 3: Evaluate the Health of the Donor

It is important that kidney donors are healthy enough to survive the loss of one of their kidneys. Medical researchers have investigated the relationship between weight, age, and exercise on the long term survival of kidney donors (survival of 10 years or more after donating a kidney). The results of their research are shown in the three graphs below.

Graph 1: Donor Weight versus Donor Long Term Survival



Graph 2: Donor Age versus Donor Long Term Survival



Graph 3: Donor Exercise versus Donor Long Term Survival



1. Use the donor survival graphs to determine the characteristics of an individual who would make an ideal kidney donor. Record this information in the appropriate row on the Donor Survival Research Data table below.
2. Use the information provided in the Donor Survival Research Data table to rank the donors' health (1 = highest survival rate, 2 = medium survival rate, 3 = lowest survival rate).

Donor Survival Research Data Table

	Weight (lb)	Age (years)	Exercise (hours per week)	Donor Survival Rank 1 = High survival 2 = Medium survival 3 = Low survival
Ideal Donor				
Donor X	130	35	10	
Donor Y	110	15	7	
Donor Z	190	70	2	

3. Based on the **donor survival research data only**, which relative (Donor X, Y, and/or Z) would you conclude should not be a kidney transplant donor? _____

Support your conclusions with evidence from the donor health data.

4. Explain why it might be dangerous for this donor to provide a kidney for the patient.

Based on **ALL of the information that you have collected so far** and your knowledge of biology:

5. Who is the best kidney donor for the patient (Donor X, Y, or Z)? _____

Explain your reasons for selecting this donor.

6. State one concern that doctors or the patient's family might have about allowing this donor to donate a kidney.

**Clinical Laboratory Test 4:
Tissue Typing: Evaluate the Match for Donor and Recipient Antigens**

Once you have identified a possible donor, further testing is necessary to determine whether the potential donor’s tissues are a good match for the patient. If the antigens on the donor’s kidney do not match the antigens on the patient’s tissue, the patient’s immune system may produce antibodies that attack the transplanted kidney and cause a rejection reaction.

Human leukocyte antigens (HLA) are special proteins found on the surfaces of cells in the body that are very important for transplantation. There are many different antigens on the surfaces of cells, but the ones that seem to be most important for transplantation are HLA Antigen A, HLA Antigen B, and HLA Antigen DR. Each person has two specific forms of these three HLA antigens.

Because HLA antigens can be recognized as foreign by another person's immune system, it is important that the donor has as many as possible of the same HLA antigens as the patient. That way, there is less of a chance that the patient’s body will reject the donated organ.

Doctors use a method called HLA tissue typing to identify which HLA antigens are present on the surface of the leukocytes (white blood cells) of the patient and the potential donor.

1. Use the HLA tissue typing kit to determine the HLA antigens present in the tissues of the patient and the HLA antigens present in the tissues of the potential donor.
2. Record the results of the HLA tissue typing by coloring in the circles that turned pink indicating the HLA antigens present in the donor and patient.

HLA Tissue Typing

	HLA Antigen A				HLA Antigen B			HLA Antigen DR	
	A-1	A-2	A-3	A-4	B-1	B-2	B-3	DR-1	DR-2
1. Patient	○	○	○	○	○	○	○	○	○
2. Possible Donor	○	○	○	○	○	○	○	○	○

3. If a possible donor has antigens that are not found in the patient those “foreign” antigens may trigger a rejection reaction. In row 2, write an **X** on the colored circles that represent donor antigens that would be mismatched (foreign) if they were transplanted into the donor.
4. How many of the possible donor’s antigens would be mismatched (foreign) if they were transplanted into the donor? _____

5. Explain why tissue type mismatches are potentially dangerous.

Read the following information on HLA Research Data and then use this information to answer the questions below.

HLA Research Data
HLA Mismatches and Kidney Transplant Survival

Patients who receive a kidney transplant are given special drugs – called immunosuppressive drugs - which suppress their immune system to help prevent rejection of the new kidney. With the new immunosuppressive drugs that are given to patients who receive a kidney, kidney rejection is not as great a problem today as it was years ago. Even with mismatched HLA antigens, 95% of all transplanted kidneys are still functioning at the end of 1 year.

6. What actions could the patient take to reduce the chance that she will reject a transplanted kidney from this donor?

7. Based on the results of the HLA testing and the HLA Research Data, do you think that this donor should provide a kidney for the patient? Support your answer with information from the results of the HLA testing and the reading.
