RECYCLEYOURSELF

An Organ, Eye and Tissue Donation Curriculum

SECTION THREE : ADVANCED READINGS

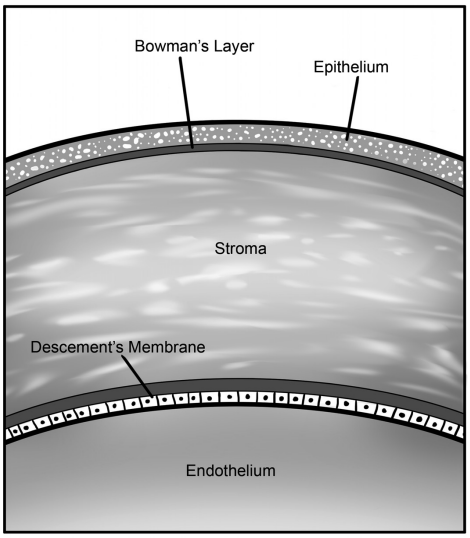
Recommended Extension Reading
for Science and Health Careers Classrooms

IN FOCUS: CORNEA DONATION & TRANSPLANTATION

Advanced Vocabulary
Cornea: (layers, anterior to posterior: Epithelium, Bowman's Layer, Stroma, Descemet's Membrane, Endothelium), Transplant Types (or Keratoplasty): Penetrating Keratoplasty, DSEK (Descemet's Stripping Endothelial Keratoplasty), DMEK (Descemet's Membrane Endothelial Keratoplasty)
Surgery Components: Trephine, Sterile Field, Aseptic Technique, Graft, Inserter, Forceps, Running Suture,
Surgery Indications: Keratoconus, Trauma, Fuch's Dystrophy, Keratitis, Bolus Keratopathy, Ulcerative Keratitis
Cornea Characteristics: Avascular, Immuno-privileged
Other Terms: allocation, contraindications, micron, allograft, xenograft, keratocytes, intra-ocular lens (IOL), rejection, specular microscope, slit lamp, Optical Coherence Tomography (OCT), limbus

A CLOSER LOOK AT THE CORNEA

Although it appears to be one clear membrane, the cornea is actually composed of five distinct layers of tissue. Each layer has its own function:



- **Epithelium** is the thin outermost layer of fast-growing and easily-regenerated cells. This layer is often scraped off by technicians before corneas are processed, but the cells grow back (from the stem-cells in the recipient's limbus) once a transplant has been completed.
- **Bowman's Membrane** was originally considered part of the stroma, because they are both made of collagen fibers. However, Bowman's Layer consists of irregularly-arranged collagen fibers – visually similar to tangled hair, as opposed to combed hair – and protects the corneal stroma. It is only 7 to 14 microns thick.
- **Stroma**, the transparent middle and thickest layer of the cornea, is made up of regularly-arranged collagen fibers and keratocytes. The layered nature of collagen fibers in the stroma make dissecting it easier. Keratocytes are specialized cells that secrete the collagen and proteoglycans needed to maintain the clarity and curvature of the cornea.
- **Descamet's Membrane** is a thin layer that serves as the modified "basement" membrane to which endothelial cells adhere.
- **Endothelium** is a single layer of cells responsible for maintaining proper fluid balance, keeping the cornea transparent. Healthy endothelial cells have similarly sized, hexagonal cells, arranged in flower petal-like patterns. Endothelial cell count is the primary measure by which eye donation specialists determine donor tissue quality.

The cornea is avascular, meaning it has no blood supply. This is important because of the way it impacts the capacity to allocate donated corneas.

When it comes to organ donation, matching blood and tissue types is critical, so as not to trigger the body's typical autoimmune response to foreign tissue: rejection. But rejection is not as much of a concern in cornea donation. Because the tissue is avascular, there is no need to find a blood type "match" between donors and recipients. The same is true when it comes to disease transmission. With no blood supply, transferable diseases have a very hard time spreading through corneal transplants. This is why corneas are referred to as immune-privileged tissue.

The avascular and immune-privileged attributes of the cornea contribute to the commonality of corneal transplants and the lack of a waiting list for those who need corneas.

WHAT IS AN EYE BANK?

An eye bank is a not-for-profit organization that obtains, medically evaluates, and distributes eyes donated for use in cornea transplantation, research, and education.

Lions VisionGift provides grafts for individuals throughout Oregon and Southwest Washington. Once local needs have been met, they routinely send additional tissues across the nation and around the world. Lions VisionGift is accredited by the Eye Bank Association of America and registered with the U.S. Food and Drug Administration.

Learn more about eye bank careers in "Interviews with Local Professionals" (p. 83).

IN THE LAB

The process of medically evaluating donated corneas begins in the lab. Eye bank technicians must carefully analyze and evaluate donated corneas to ensure that the corneas are healthy enough for transplant and that the tissue is free of any disease or virus that could harm the recipient. Tests performed include:

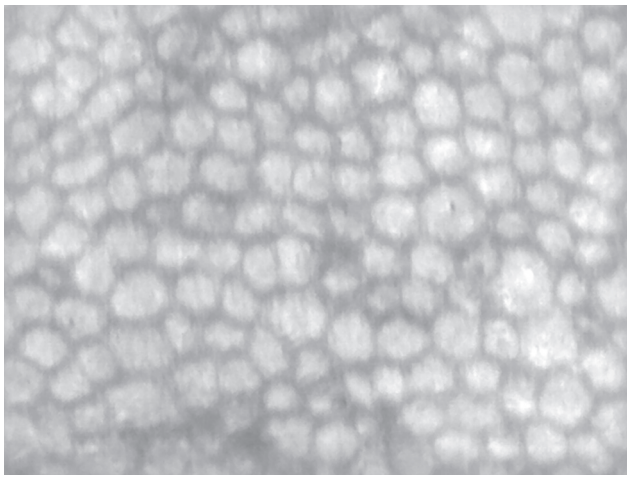
1. **Specular Microscopy**
   A specular microscope uses light refraction to display the endothelium to eye bank technicians. Technicians count cells on a computer program that runs an algorithm to determine the cell density. A cornea needs to have a cell density of 2,000 cells per square millimeter to be transplantable. Endothelial cells degrade with age and do not regenerate, so older donors typically have fewer cells than younger ones.

2. **Slit Lamp Evaluation**
   The second microscopy technique used is the slit-lamp examination. If you have ever had an eye examination, an ophthalmologist has used this instrument to inspect your eye health. The slit lamp uses a narrow beam of light and an off-set optic viewpoint to create a figurative 'cross-section' of the cornea.

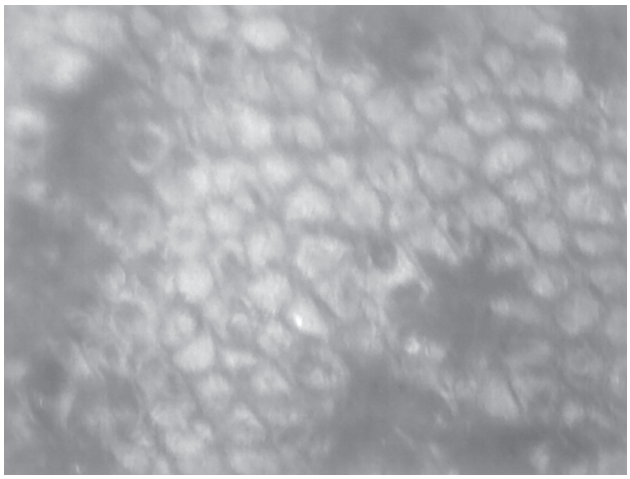
   

   Imagine your cupped hand is a cornea. If you slide the fingers of your opposite hand between your middle and ring fingers of the cupped hand, you can imagine the now exposed side surface of your middle finger to be the different layers of the cornea. In this way, eye bank technicians can examine the entire depth of the cornea for hard-to-see scarring or dysfunction.

3. **Optical Coherence Tomography (OCT)**
   The OCT is the final microscopy tool used to evaluate corneas. Light beams are scanned across the cornea in a systematic fashion creating hundreds of 'slices' which a computer program then converts to an image which can be used to visualize the interior of the tissue. OCT also evaluates tissue that technicians have cut in the lab to ensure thickness and adherence of the graft.



Healthy Endothelial Layer



Unhealthy Endothelial Layer

Images courtesy LionsVisionGift

WHAT IS A CORNEAL TRANSPLANT?

Around 46,000 Americans receive corneal transplants every year, making it the most common transplant surgery. Corneal transplant (keratoplasty) is the process of removing and replacing damaged cornea tissue with healthy donor tissue.

During a corneal transplant, a specially trained surgeon removes the damaged or diseased cornea – or portion of cornea – from the patient's eye. The patient's cornea is then replaced with the healthy, donated cornea, which is prepared to fit perfectly into the patient's eye.

THE DEVELOPMENT OF CORNEAL TRANSPLANT SURGERY

Blindness from corneal damage has been known since the earliest times of human history. Ancient Egyptians and Greeks wrote about theoretical cures and treatments for the condition. Legends and myths about receiving "new eyes" can be found across the centuries.

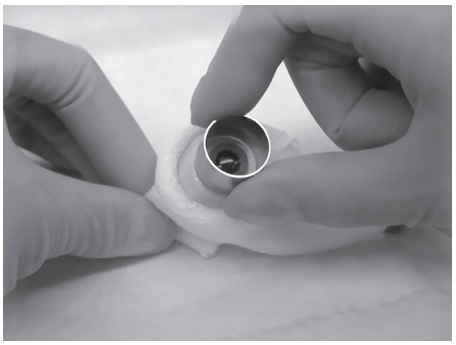
It wasn't until the 19th century that doctors began in earnest to attempt corneal transplants. In 1818, Franz Riesinger experimented replacing opaque human corneas with transparent animal corneas (a xenograft).

Although the technique ultimately failed, Riesinger coined the procedure a keratoplasty (kerato is Greek for cornea; plasty means formation), a term which is still used today.

▶ **READ ONLINE!**

The Legend of St. Lucy

The Three Army Surgeons
by the Brothers Grimm



Research in medical science continued, producing new tools ranging from anesthesia to the trephine (a cylindrical surgical instrument; see photo courtesy Lions VisionGift) (Moffatt & Cartwright, 2005).

The first successful corneal transplant took place in Austria, in 1905. Eduard Konrad Zirm utilized human donor corneas to replace the damaged tissues of Alois Glogar (an allograft). Glogar had received chemical burns from lime while cleaning out his chicken coop. The use of allografts, as opposed to xenografts, was determined to be essential for the success of keratoplasty procedures.

Although the procedure now worked, there was an extremely limited supply of donor tissue. This did not change until the 1940s, which saw the development of advanced antibiotics. The world's first eye bank opened in New York in 1944, and along with it the world's first "anatomical gift" donation program in which people could pledge their corneas to help others after their death. An eye bank recovers, processes, stores, and brokers eye tissue for transplant and research purposes (Crawford, 2013).

SURGICAL TECHNIQUES: PENETRATING KERATOPLASTY

A full-thickness cornea transplant, or penetrating keratoplasty, is a modern surgical technique in which the entire thickness – all five layers – of a damaged cornea is replaced with a healthy donor cornea. This is an effective technique when all five layers are damaged (for example, in the case of a Kerataconus, severe chemical burns or a penetrating trauma).

Surgeons use a trephine (pronounced tree-fine) to remove the donor cornea, and make a corresponding hole in the recipient. Think of a trephine as a cookie cutter, punching through all five layers of the cornea. The donor 'button' is then sewn into the corresponding trephinated space in the recipient's cornea with a running suture. Sutures are thinner than a human hair, so this is performed under a microscope. Complete visual recovery can take up to a year.

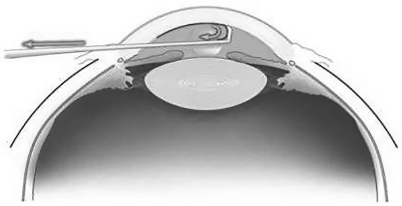
SURGICAL TECHNIQUES: DSEK / DMEK

While it was once common for every corneal transplant to be a Penetrating Keratoplasty, techniques pioneered over the past 20 years are allowing surgeons to target specific layers within the cornea. This means that if only a single layer of the cornea is damaged, it alone can be replaced with a corresponding layer from a donor cornea.

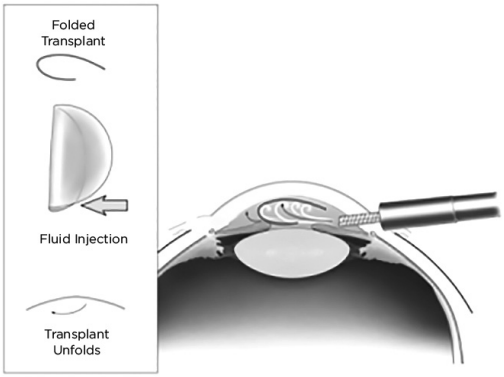
For example, someone suffering from Fuch's Dystrophy is a likely candidate for a DSEK or DMEK surgery. Fuch's Dystrophy is a hereditary condition wherein the endothelial layer of the cornea has cell death and subsequent dysfunction.

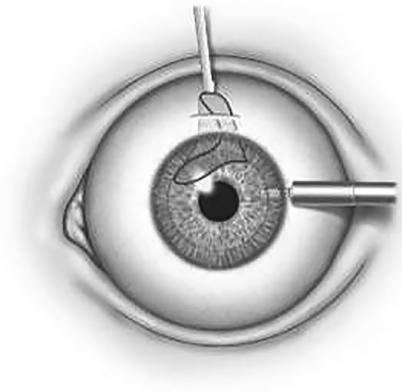
Researchers at Lions VisionGift have played a key role in developing these new, targeted techniques. Descemet's Stripping Automated Endothelial Keratoplasty (DSAEK) is one example.

1. A tiny incision is made in the sclera.
2. A small tool is inserted to scrape off the diseased or damaged endothelium layer. This layer can be removed without disrupting the other layers.

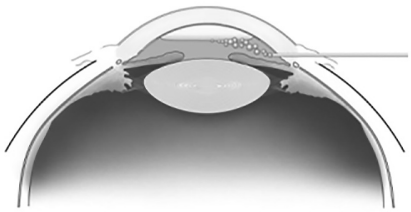


3. The donor cornea is folded in half prior to insertion. Because the folded cornea resembles a tiny taco, this is referred to as the 'taco technique.'

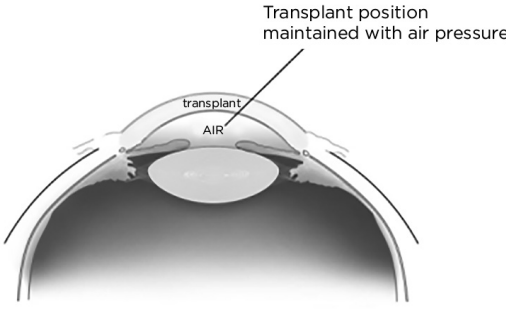




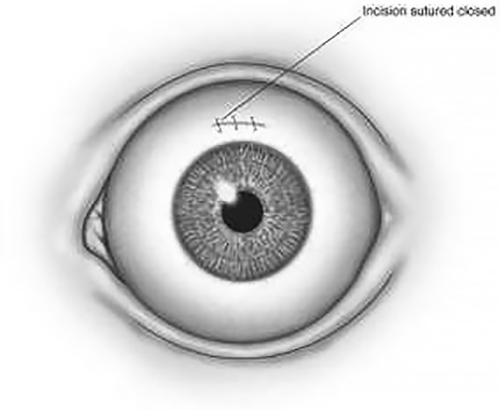
4. Air bubbles are inserted behind the transplanted tissue. The 'taco' pops open; it floats up and adheres itself to the stroma.



5. The transplant is held in place by this small pocket of air.



6. Stitches may not be necessary, but one or two is common.



7. After the procedure, patients must remain on their back for 24 hours so that the new cornea will not dislocate. If the graft detaches, a repeated air injection can reattach the graft.

Descamet's Membrane Endothelial Keratoplasty (DMEK) is an even newer technique in which an even thinner piece of tissue is transplanted.

IN FOCUS: CORNEA DONATION & TRANSPLANTATION Questions for Reading Comprehension

1. Name the five layers of the cornea, in order from external to internal.
2. Why are donated corneas inspected for their cell count?
3. Name three advances in medical technology which assisted with the development of corneal transplant surgery.
4. Describe a penetrating keratoplasty procedure.
5. What is the key difference between penetrating keratoplasty and a DSEK or DMEK?
6. Describe a scenario of why a person may need a corneal transplant. Include a short summary of the trans plant process this person will undergo in 3-5 sentences using key vocabulary from this section.

IN FOCUS: TISSUE DONATION

Advanced Vocabulary
Allograft, autograft, xenograft, mechanical heart valve

TYPES OF GRAFTS

- An allograft is when cells, tissues or organs come from another person (same species).
- An autograft is when cells or tissues are transplanted from one place to another on the same person. There is more potential for pain and infection compared to an allograft.
- A transplant from another species, like a pig to a human, is called a xenograft. According to the World Health Organization, this type of transplant carries many risks. It is a topic for research and clinical trials.

Adapted from Donate Life Colorado

A LIFE SAVING AND LIFE ENHANCING GIFT

Allograft tissue is voluntarily donated by deceased donors who, prior to death, made the decision to donate by registering as a donor and discussing their wishes with their family. Because allografts can be used in so many ways, for so many surgical procedures, a single donor can potentially enhance or save the lives of up to 50 or more recipients.

Allografts are a common option for patients who suffer from a wide variety of conditions and injuries. In some cases (but not always), the treatment options can include allograft, autograft, mechanical, or xenograft options. The advantage of opting for an allograft is that the patient's body accepts and heals the tissue in a way which synthetic grafts cannot imitate.

For example, someone living with a congenital and degenerative heart valve condition may be offered the choice between a mechanical or allograft heart valve. Choosing a mechanical heart valve means the patient must take blood-thinning medications for the rest of their life. This would be problematic if the patient were, say, a female who might want to one day have children. Physicians discuss the advantages and disadvantages of all options with their patients.

WHAT TISSUES CAN BE DONATED?

HEART VALVES

Blood is pumped through the heart's four chambers, aided by four heart valves that open and close and prevent blood from flowing backward.

- Infections and age-related diseases can damage heart valves. Some children are born with malformed valves.
- Heart valves can be recovered when the whole heart is determined not to be viable for transplant.
- Donated human vessels and valves are used as replacements that can mean the difference between life and death to recipients.

VEINS
Arteries carry oxygenated blood from the heart to the rest of the body, and veins bring the deoxygenated blood back.

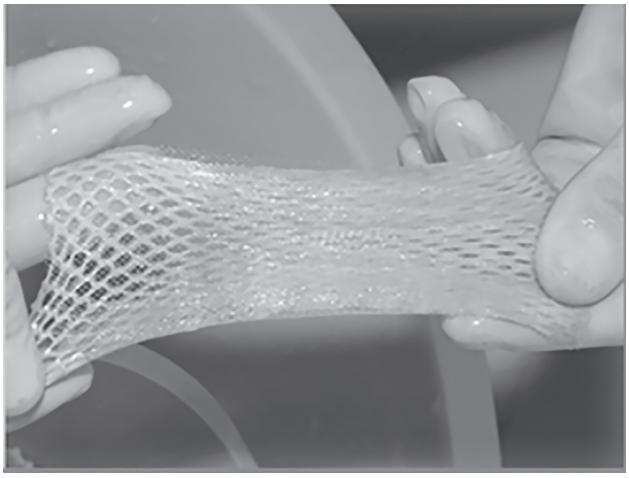
- Many people lose circulation in their legs, or even in their heart, due to disease or trauma.
- Donated femoral and saphenous veins are used to restore circulation and avoid leg amputation for people suffering poor circulation, such as diabetics.

BONE
Bones consist of living protein fibers that constantly rebuild themselves.

- The humerus, radius and ulna are the bones in the arm that can be recovered.
- The femur, tibia and fibula (leg bones) and the pelvis can be recovered.
- Bones can be transplanted in order to prevent amputation, promote healing, and maintain mobility and structure.
- After the bone is recovered, trained professionals replace the bone with prosthetics for funeral viewing arrangements.

SOFT TISSUE
Soft tissue includes tendons, ligaments and cartilage.

- Soft tissue helps individuals with various orthopedic and neurological conditions. Common examples include back, joint and leg surgeries, such as hip replacement, knee reconstruction, and spinal fusion.
- Torn ACLs in athletes are one of the most common reasons for which allografts are needed.



Recovered and processed skin graft. Image courtesy Donate Life Northwest.

SKIN
About 21 square feet of skin, weighing up to 15 pounds, covers the average adult. Not only is skin the body's first line of defense against microbes, but it also regulates heat and fluids in the body.

- Skin can be used to aid in the healing process for severe burn victims and people who suffer from a disfiguring injury or disease, acting as a biological bandage until the patient can heal.
- Skin can help regenerate new soft tissue for cancer patients, trauma victims and patients with severe abdominal defects. Skin also helps reconstruction from mastectomy procedures and to repair hernias.
- Donated skin grafts protect recipients from infection while promoting regeneration of their own skin.

- Skin from donors is removed from the trunk and the back and front of the legs.
- Recovered skin is about the thickness of a piece of paper.
- Donation of skin does not affect the appearance of a donor nor viewing at funeral services.

A skin graft recovered from a donor is 18/100th of an inch thick, and run through a mesher to double its surface area and make it more pliable.

PERICARDIUM
A double-layered connective tissue lining the heart.

- Used as a patch to help cardiac, bladder, brain, and dental surgeries.

HOW TISSUE DONATION WORKS

In Oregon, Southwest Washington, and Southern Idaho, Donor Recovery Coordinators from Community Tissue Services oversee the tissue donation process.

REFERRAL
There are many variables that matter when it comes to tissue donation: age, timelines, certain diseases or injuries, but nearly anyone can be an eye and/or tissue donor. Hospitals are required to report all deaths to tissue and eye banks.

AUTHORIZATION FOR DONATION
A tissue donation specialist will check the Registry to see if the deceased person has already registered as a donor. If the individual's wishes are unknown, the specialist will discuss the option of donation with the family.

EVALUATION
Once authorization is verified, or authorization is given by the potential donor's family, the donor is thoroughly evaluated using a medical/social history questionnaire, medical records, blood tests, and physical examinations.

TRANSPORT AND TISSUE RECOVERY
A medical team is dispatched to recover the medically suitable tissue. The donor is treated with the utmost respect and dignity. Once tissue recovery has been completed, the team performs any necessary reconstruction and sutures all incisions to restore the appearance of every donor.

Following the recovery process, a funeral can be held with minimal delay. There can be an open casket funeral, viewing or other standard memorial.

PROCESSING AND TRANSPLANTATION
Recovered grafts are rigorously screened, tested and prepared for use in surgical procedures. Once the tissues are prepared, surgeons throughout the United States request tissue in order to perform a wide variety of surgical procedures which require allografts.

FOLLOW UP WITH FAMILY
The families of tissue donors receive non-identifying information about the patients whose lives have been saved or enhanced thanks to their loved one's gift.

IN FOCUS: TISSUE DONATION
Questions for Reading Comprehension

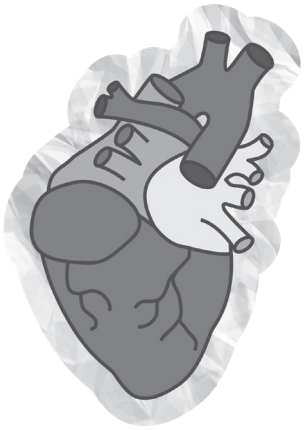
1. Why might a patient require an allograft over a mechanical graft? Over an autograft?
2. Name two specific ways tissue donations save lives.
3. How might a diabetic patient benefit from a tissue transplant?
4. How might a patient with a cancerous bone growth benefit from a tissue transplant?
5. How might a patient with a torn ACL benefit from a tissue transplant?
6. Who can be a tissue donor?
7. Why is it important to talk to your family about your decision to be/not be a tissue donor?

IN FOCUS: RECYCLABLE ORGANS

Advanced Vocabulary
Atherosclerosis, triglycerides, electrolyte, gestational

Visit UNOS Organ Datasource for detailed information on the functions of each organ.

THE HEART



The heart is a muscular pump about the size of a fist that circulates blood carrying oxygen and nutrients to, and wastes from, the body's cells. The right side of the heart circulates blood to the lungs. The left side circulates blood to the rest of the body and back to the heart.

Common diseases that may lead to transplantation:

CORONARY HEART DISEASE

A narrowing or blockage of the coronary arteries which provide the heart muscle with blood. The disease occurs when these arteries become hardened and narrowed. A plaque builds up along the inner walls of the arteries, known as atherosclerosis. As the coronary arteries narrow and harden, less blood can flow through them to the heart. As a result, the heart receives less oxygen than it needs.

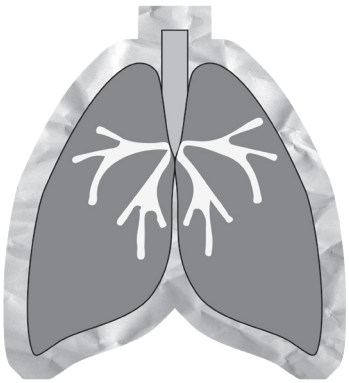
- Causes of coronary heart disease include but are not limited to: obesity, smoking, excessive alcohol consumption, high sodium diets and a sedentary lifestyle.

CARDIOMYOPATHY

An abnormality of the heart muscle which affects the heart's ability to pump blood and deliver it to the rest of the body.

- There are many causes which may include coronary heart disease, heart valve disease, or, rarely, viruses.

THE LUNGS



The lungs are a pair of highly elastic and spongy organs in the chest. They are the main organs involved in breathing: oxygen passes into the bloodstream through microscopic air sacs in the lungs, while waste carbon dioxide passes out of the bloodstream into the lungs.

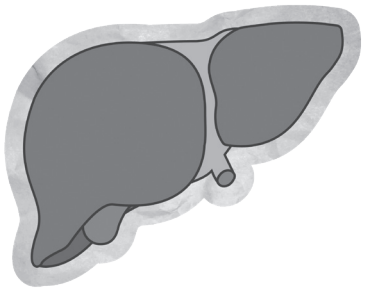
Common diseases that may lead to transplantation:

CYSTIC FIBROSIS

An inherited disease which can cause respiratory failure. Cystic fibrosis affects the cells that produce mucus, sweat, saliva and digestive juices. Normally, these secretions are thin and slippery, but with cystic fibrosis, a defective gene causes the secretions to become thick and sticky. Instead of acting as a lubricant, the secretions plug up tubes, ducts and passageways, especially in the pancreas and lungs.

THE LIVER

This large organ is made up of a spongy mass of wedge-shaped lobes. It performs over 500 individual functions vital to survival. For example, the liver helps process carbohydrates, fats, and proteins, and stores vitamins. It processes nutrients absorbed from food in the intestines and turns them into materials that the body needs for life. It makes the factors that the blood needs for clotting. It also secretes bile to help digest fats, and to break down toxic substances in the blood, such as drugs and alcohol.



Common diseases that may lead to transplantation:

NON-ALCOHOLIC FATTY LIVER DISEASE

The buildup of extra fat in liver cells that is not caused by alcohol. The liver swells, leading to scarring (cirrhosis) over time.

- This condition, the most common reason for liver transplants in the United States, tends to develop in people who are overweight or obese or have diabetes, high cholesterol, or high triglycerides.

HEPATITIS

An inflammation of the liver, characterized by the destruction of a number of liver cells.

- **Hepatitis A** is most commonly transmitted by ingesting food or water contaminated by infected feces.
- **Hepatitis B** is spread through having contact with blood or body fluids with someone who already has a hepatitis B infection.
- **Hepatitis C** is contracted sexually, through blood transfusions or shared needles during drug use.

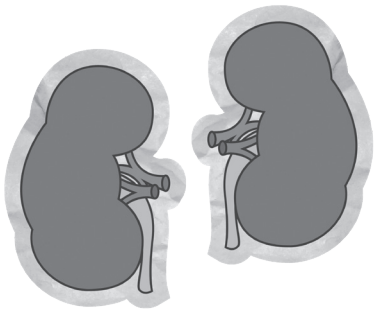
THE KIDNEYS

Kidneys are a pair of reddish-brown organs whose primary function is to remove waste from the body through the production of urine. They also help to regulate blood pressure, blood volume, and the chemical (electrolyte) composition of the blood.

Common diseases that may lead to transplantation:

HIGH BLOOD PRESSURE (HYPERTENSION)

Occurs when the pressure of your blood against the walls of your blood vessels increases. Obesity, smoking, excessive alcohol consumption, high sodium diets and sedentary lifestyle are all factors that can lead to hypertension.



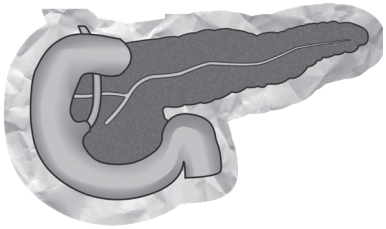
DIABETES

When your blood sugar is too high, the kidneys are forced to overwork. Over time, this causes kidneys to lose their filtering ability.

- **Type 1 Diabetes**: Often diagnosed in children and adults. Occurs more often in African Americans, Native Americans, Hispanic Americans, and women with a family history of diabetes.

- **Type 2 Diabetes**: Typically occurs in adults. Occurs more often in African Americans, Native Americans, Hispanic Americans, and women with a family history of diabetes.
- **Gestational Diabetes**: Develops only during pregnancy.

THE PANCREAS



The pancreas produces enzymes that are used for digestion, and insulin, which regulates blood sugar throughout the body.

Pancreatic transplants are rare. Only 1.2% of all transplants are pancreas transplants, and an additional 3.2% are kidney/pancreas transplants.

Common diseases that may lead to transplantation:

DIABETES

See DIABETES section above.

THE INTESTINE

The intestine is the lower part of the digestive tract, which extends from the stomach to the anus. The first part is a long, narrow, and convoluted section referred to as the small intestine. Its function is to complete the digestion and absorption of nutrients into the bloodstream. The second part – the large intestine – absorbs water from wastes, creating stool.

Intestinal transplants are extremely rare. Less than 0.05% of all transplants are intestinal transplants.

Common need for transplantation:

Some people are born with or develop irreversible intestinal failure, preventing them from digesting food or fluids. The majority of intestinal transplants are performed in infants and children.

IN FOCUS: RECYCLABLE ORGANS
Questions for Reading Comprehension

1. Why might a patient require a heart transplant?
2. What is the function of the lungs?
3. Why might a patient require a liver transplant?
4. What is one way someone may reduce their chances of having kidney failure?
5. How common are pancreas transplants?
6. What is the function of the small intestine?

IN FOCUS: DECEASED ORGAN DONATION

Advanced Vocabulary
Allocation, anoxia, artificial support, brain stem, brain death, cell metabolism, cerebrovascular injury, coma, mechanical ventilation, medical urgency, persistent vegetative state, window of viability, United Network of Organ Sharing, Organ Procurement and Transplantation Network.

Of the 2.2 million people who die in the United States each year, relatively few die under circumstances that make them medically eligible to be either organ or tissue donors. In this section, we'll take a closer look at some of the medical science and ethics behind organ donation and allocation.

INTENSIVE CARE

When a patient enters emergency care in critical condition, advanced measures are taken to support their failing bodily functions. When patients are treatable or curable, artificial support is temporary until the body recovers and can resume its normal functioning. Examples of common artificial support include:

- Artificial hydration
- Artificial nutrition
- Mechanical ventilation

The main job of our lungs is to get oxygen into the body and to get rid of carbon dioxide. Like a pump, mechanical ventilation accomplishes both of these functions for a patient who cannot breathe on their own.

When someone on a mechanical ventilator dies, the machine ensures that oxygen and blood continue to circulate through their vital organs and cells. Mechanical ventilation can remain in place right up until the organ recovery surgery begins – for a few hours or even a few days – giving their family time to discuss the possibility of organ and tissue donation, and to say goodbye.

WHAT IS BRAIN DEATH?

Brain death is usually the result of a severe trauma which causes brain tissues to swell. Some examples:

- Trauma: for example, a severe head injury during a motor vehicle accident.
- Cerebrovascular injury: massive bleeding caused by a stroke or ruptured aneurysm.
- Anoxia: loss of oxygen to the brain caused by drowning, a heart attack, or drug overdose.
- Uncontrollable growth of a brain tumor that causes permanent loss of blood flow and oxygen to the brain.

When the brain is injured, it responds in much the same way as an injury like a twisted ankle: it swells. Unlike the muscles and tissues of the ankle, however, the brain is in a confined space – the skull – and has no room to swell.

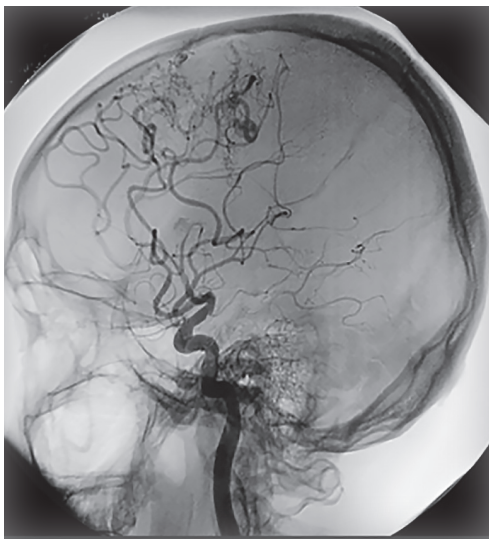
As the brain swells inside the skull, it pushes downward toward the brain stem blocking all upward flow of blood. Depending on the type of injury, this may happen within minutes or over a period of days. Even while the heart is still beating and supplying blood to the rest of the body, blood that carries oxygen cannot reach the brain or the brain stem, which controls heart rate and breathing. The result is that the brain, and therefore the person, dies.

The physicians who test for brain death are not a part of the donation or transplantation team. They are focused only on trying to save the patient's life, and once that is not possible, on providing an accurate diagnosis of death.

To avoid even the smallest chance of mistake, the physician must conduct an in-depth range of standardized tests showing that there is absolutely no brain function before declaring the patient dead.

BRAIN DEATH VS. COMA

Brain death can be a confusing concept, because a brain dead person on a ventilator can feel warm to the touch and can look "alive." Their heart beats, and it appears as though they are breathing. Why is this? Because the individual was placed on a mechanical ventilator prior to death, the ventilator is pushing air into the lungs, making the person's chest rise and fall, allowing the heart to continue to beat. However, once the mechanical ventilator is removed, the heart will stop due to lack of oxygen.



Healthy brain

Brain death; showing no blood flow within the brain or brain stem.

Brain death is not a coma. When brain death occurs, all brain tissue is dead, no blood flows to the brain, and no electrical activity is present in the brain. Both the lower and upper part of the brain has stopped functioning. In a coma, only a portion of the brain is injured; the brain still receives blood flow and electrical activity is present. Someone in a coma or persistent vegetative state is still alive: they retain neurological function and may, with time, recover.

Because someone who has died of brain death may appear as though they are simply sleeping or in a coma, some families tragically expect that the person they love can simply be kept on the ventilator in hopes that their condition will improve. But to be brain dead is to be dead, and no improvement or recovery is possible. There is no method to jump-start or revive a brain that has been deprived of blood and whose cells have died.

ORGAN RECOVERY

Once the family of a deceased donor has been given time to say their goodbyes, and all the transplantable organs have been matched by transplant surgeons for their potential recipients, surgical recovery begins.

A transplant surgical team arrives at the deceased donor's hospital. The patient is taken to an operating room, where organs and tissues are recovered in the same sterile and careful way as in any surgery. All incisions are surgically closed. Organ and tissue donation does not interfere with funeral arrangements, including open-casket funerals.

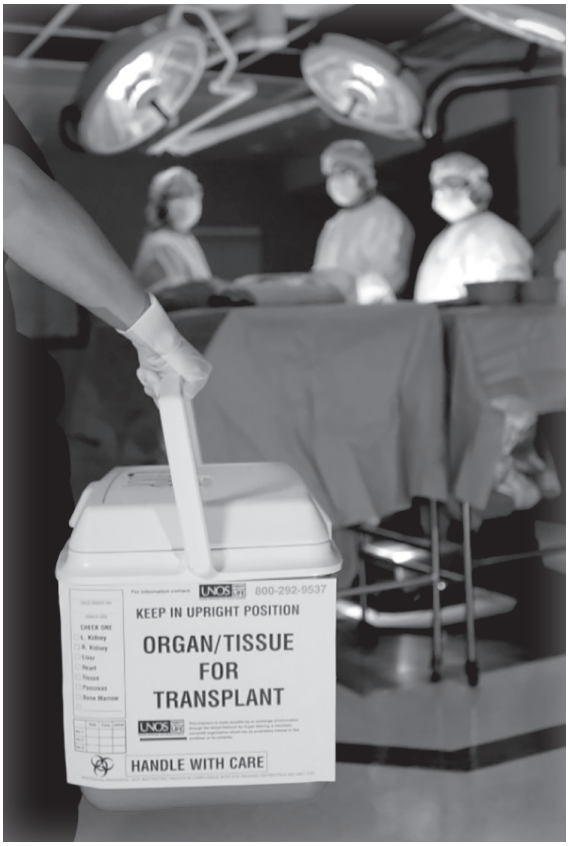


Image courtesy of LifeCenter of Ohio

PRESERVATION AND TRANSPORT

Donated organs require special methods of preservation to keep them viable between the time of recovery and transplantation. Without preservation, the organ will die.

For organs to be recovered and work in a recipient they must be cooled and the blood must be removed within minutes of the cessation of blood flow. Cooling the organs during the recovery surgery slows down cell metabolism. This conserves the oxygen stored within the cells and slows down cell death. The blood is removed to prevent the formation of clots that would damage the organ and prevent its use in a recipient.
Different organs have different "windows of viability." The window of viability restricts the geographic distance a donor organ can travel.

Cold storage, in which donor organs are literally placed on ice in a small cooler, has been the standard for transporting organs since the 1970s. However, it is not a foolproof method. Traffic jams, bad weather, and mechanical problems can cause serious delays, whether the organs are transported by air or by car. Sometimes, despite the best efforts, organs deteriorate during transport. They sometimes do not survive the cold preservation process, and so ultimately cannot be transplanted.

ORGAN	WINDOW OF VIABILITY
HEART	4 - 6 HOURS
LUNGS	4 - 6 HOURS
LIVER	8 - 12 HOURS
PANCREAS	12 - 18 HOURS
KIDNEY	24 - 36 HOURS

ADVANCES IN TRANSPLANT TECHNOLOGY

Advances in technology may have a dramatic impact on the availability of organs for donation. By improving the cold storage system, organ function may be imrpoved and the windows of viability can be lengthened, in turn, saving more lives.

Devices are currently being tested to pump hearts, lungs, and livers after they are recovered from the donor. Kidney pumps are already in wide use, including at Pacific Northwest Transplant Bank.

These devices pump preservation solution through the organ, which means cells continue to function and the organ can be better monitored. This may significantly lengthen the window of viability and improve the function of the organ once it is transplanted.

ALLOCATION

Objective medical criteria determine who receives a donated organ. The allocation process is governed by national policy, created by a community of transplant professionals and patient representatives.

1. An organ is donated. An OPO donation specialist enters medical information about the donor – including organ size and condition, blood type, and tissue type – into the national UNOS database.
2. The UNOS database generates a list of candidates on the waiting list who have medical profiles compatible with the donor's.
   a. MEDICAL URGENCY
      For organs such as the heart, liver, and lung, people who are in the sickest condition get priority for the next available organ.
   b. GEOGRAPHY AND DISTANCE
      The computer uses a radius from the donor hospital to help allocate organs to matching recipients who have time to travel to their transplant hospital within the window of viability.
   c. SIZE
      For example, children respond better to child-sized organs, so pediatric candidates are first in line for other children's organs.
3. Transplant centers are notified and offered the organ which matches their patient.
4. Transplant teams consider the organ, and whether it is in the patient's best interest to undergo surgery.
5. The organ is accepted or declined. If an organ is turned down for one patient, it will be offered to the next patient on the list who is a match for that organ. This continues until the organ is placed.

Why would a transplant team turn down an organ? They may feel that the donor and recipient are not a close enough match. For example, if the donor is much larger or smaller than the recipient, the size of the organ could literally make it a "bad fit."

THE ETHICS OF ORGAN ALLOCATION

Because there aren't enough donated organs to transplant everyone in need, organs must be allocated in the most equitable way possible while making the best use of the organ. That means balancing factors of justice (fair consideration of candidates' circumstances and medical needs) with factors of medical utility (optimizing the number of transplants performed as well as how long the patients and organs survive).

Several countries around the world have developed national systems to oversee the development, monitoring and enforcement of policies which govern organ allocation as ethically as possible. In the United States, the non-profit organization United Network for Organ Sharing (UNOS) has been contracted by the U.S. Department of Health and Human Services to administer this service since 1984.

Organ donation is one of the most regulated areas of health care in the United States. This means that all organ, eye and tissue agencies, hospitals and transplant centers in the nation follow specific parameters and guidelines. Failure to follow regulations entails heavy penalties. One of the most famous federal regulations regarding organ donation was passed by Congress in 1984:

THE NATIONAL ORGAN TRANSPLANT ACT

- Made the buying or selling of human organs a federal crime
- Established the Organ Procurement and Transplantation Network, to maintain a national registry for matching and allocating organs (administered by the non-profit organization UNOS)

You can read about the specific policies which direct American organ donation online at unos.org

UNOS DONATE LIFE®

UNITED NETWORK FOR ORGAN SHARING

IN FOCUS: DECEASED ORGAN DONATION
Questions for Reading Comprehension

CLOSE READING

1. What role does mechanical ventilation play in organ donation?
2. What is the difference between brain death and a coma?
3. Name three criteria which can impact who will receive an organ transplant.
4. What impact do the windows of viability have on organ donation?
5. Can you buy or sell an organ in the United States? Why or why not?

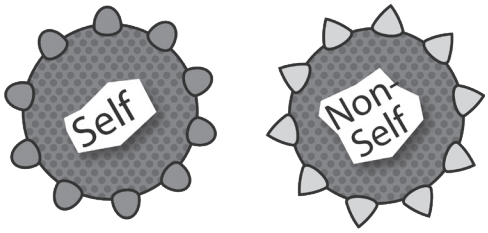
THINK CRITICALLY

1. Do you think that organ donation is common? What specific evidence can you find in the reading to support your opinion?
2. News reports - online, on the TV or radio - often confuse brain death and coma. Why do you think this may be?
3. Why do you think the National Organ Transplant Act specifically mentions the buying or selling or organs?
4. Do you think there is a "black market" for organ donations in the United States? Go online to research the topic. Carefully note the source of your information, including the country, date, the author's credentials, and the institution or organization with which the author is associated.

IN FOCUS: ORGAN TRANSPLANTS

Advanced Vocabulary
Antibodies, antigens, compatibility, crossmatching, microorganism, human leukocyte antigens, immune system, immunosuppression, rejection

Ethnicity and gender do not impact whether two people can be a match. At the same time, people of the same ethnicities frequently match one another, carrying compatible blood types and tissue markers. A greater diversity of donors means a better chance for everyone to find their match.



While organ transplants can restore someone's health, and greatly improve their quality of life, they are not a cure. There will always be some risk of rejection, and a lifetime of special care will be required to support the donated organ.

COMPATIBLE OR INCOMPATIBLE?

Each person has thousands of genes. The expression of these genes is what makes us unique. Some of the effects of these genes are visible – displayed in features like hair and eye color. However, many are not so obvious, expressed within our bodies in blood and tissue proteins. These inherited proteins, called antigens, determine a person's blood and tissue types. Organized before you were even born, they act as cell markers, telling your cells where to go and which cells to join. Antigens are markers on the surface of blood and tissue cells which identify the cell as "self."

The uniqueness of an individual's cell surface markers explains why organ donor tissue and recipient tissue must be carefully matched. If a "non-self" antigen is detected within the body – say, because bacteria, virus, or a transplanted organ has been introduced into the body – antibodies are summoned to attack it. Antibodies are small proteins which circulate throughout the body, used by the immune system to identify and destroy foreign objects. Antibodies protect us from infection, by effectively creating and mobilizing a virtual army to defend us from any foreign antigens they encounter. While this is beneficial in keeping us healthy, it poses a special challenge for transplant recipients.

If you place an organ with an incompatible blood or tissue type into a recipient's body, the recipient's immune system goes on the offensive. Incompatible, or "mismatched," antigens on the surface of the transplanted organ can stimulate the production of antibodies. Antibodies may attack the organ and attempt to kill the organ's cells. This process is called rejection, and it may eventually destroy the organ.

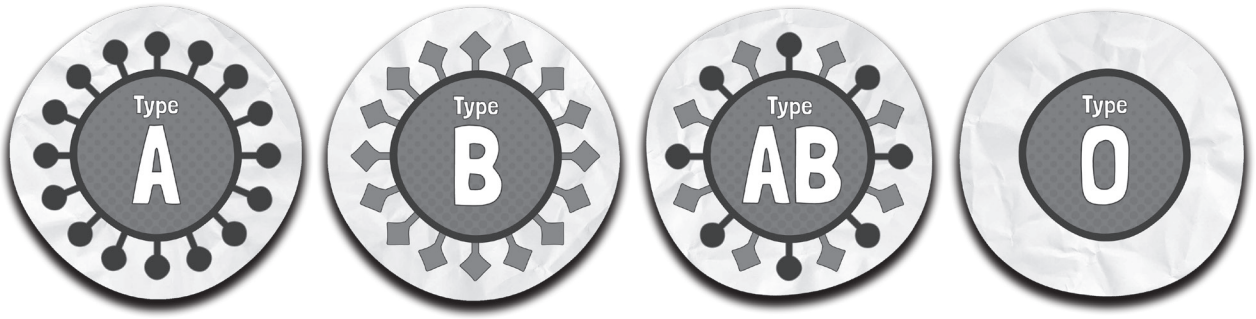
Since antigens and antibodies can play an important role in transplantation, we'll take a closer look at the two systems of antigens which impact the ability the matching of donated organs with potential recipients: ABO (blood type) antigens and HLA (tissue) antigens.

ABO COMPATIBILITY

All blood is made of the same basic elements, but not all blood is alike. There are four major blood types which are determined by the presence or absence of particular antigens. While the Rh factor (what makes blood "positive" or "negative") matters if you are receiving a blood transfusion, it does not need to be matched if you are receiving a solid organ transplant (heart, kidney, liver, etc.). That is because the Rh factor is not expressed on solid organs.

Your red blood cells have antigens on their surface, which determine what blood type you are:

- **GROUP A:** has only A antigens
- **GROUP B:** has only B antigens
- **GROUP AB:** has both A and B antigens
- **GROUP O:** has neither A nor B antigens; red blood cells are "bare" in people with blood type O.



For transplant purposes, it is critical that blood types are compatible. If a patient were to receive an organ from someone with an incompatible blood type, his or her body would recognize the organ as foreign and try to destroy it.

For example, if you are blood type A, the cells in your body trigger an army of antibodies when they encounter type B antigens. Your body kills off any cells which contain type B antigens.

PATIENT BLOOD TYPE	COMPATIBLE DONOR BLOOD TYPE
O	O
A	A O
B	B O
AB	A B AB O

To learn more about blood types and matching, visit redcrossblood.org

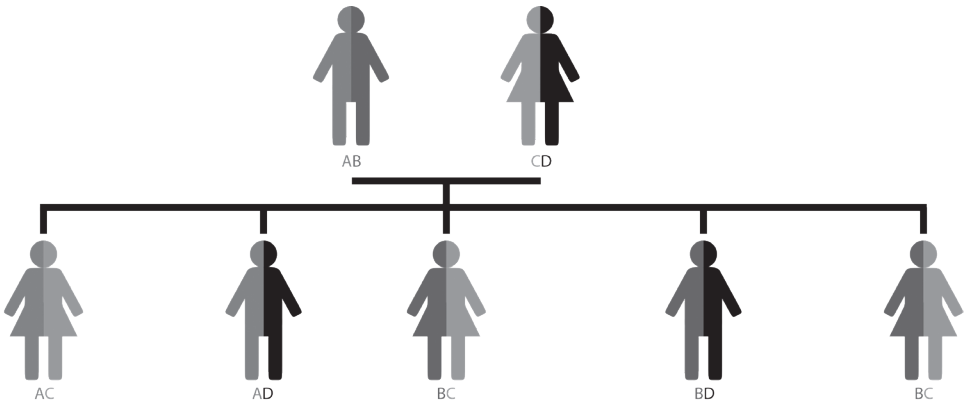
HLAS: HUMAN LEUKOCYTE ANTIGENS

There is a second set of antigens which is important for organ transplant, called the HLA System.

Human leukocyte antigens (HLAs) are proteins which form your unique "genetic social security number." Identifiable as genetic markers on the surface of almost all the cells in your body (except red blood cells), they are inherited from your parents. You are always a half tissue match with your biological parents, because you receive 50 percent of your genetic material from your mother, and 50 percent from your father. No two people – except identical twins – have identical HLAs.

For transplant purposes, six major HLA antigens are identified in both the recipient and their donor (living or deceased). These six major HLA antigens come from a pool of over 150 HLA antigens that have been identified in the human population. It is fairly unusual for people who are not blood relatives to share more than one or two HLA antigens in common. While it is not necessary to share any HLA antigens in common for a transplant to be successful, studies show that well-matched organ transplants do last longer.

Below is a graphic representation of inheritance of HLA antigens within a family. As noted, you are a half match (3 of 6 antigens) with your parents, but you can share zero, three or six antigens in common with your siblings.



HLA matching has become less important because today's immunosuppressive drugs – medicines that can subdue the body's response to a transplanted organ – have improved greatly since the early days of transplant science. In fact, thanks to advances in transplant science, a recipient may receive a transplant even when HLA antigens are a total mismatch as long as their blood type is compatible with that of the organ donor, and the crossmatch test is also compatible.

CROSSMATCHING

The crossmatch is the final test which determines if the recipient and donor can be safely transplanted. It involves mixing white cells from a potential donor with serum from the recipient's blood. Crossmatches are "transplants in a test tube," allowing the transplant team to determine if a recipient has "preformed" or already existing antibodies against a particular donor.

Think back to the function of antibodies. Once we have been infected with a particular germ, the immune system remembers the particular antigen which identifies that germ. So, if you contact that germ again, the body will know to quickly mobilize its army of antibodies to block and destroy the germ before it can cause another infection.

A similar scenario can occur when someone has been exposed to foreign tissue. People can be exposed to foreign antigen markers through transfusions, pregnancy, or previous transplants. Their body can 'remember' those foreign antigens and attack them with its pre-formed team of antibodies. Interestingly, we all can have very different reactions to exposure: some people make a lot of antibodies after an exposure, and those antibodies remain active for a very long time, while others do not make antibodies, or the antibodies they do make can weaken or disappear over time.

The recipient's serum contains any active pre-formed antibodies that the recipient has made as a result of previous exposure to foreign human tissue. The goal is to determine whether the recipient's body will respond to the transplanted organ by attempting to reject it.

	CROSSMATCH RESPONSE	COURSE OF ACTION
POSITIVE CROSSMATCH	There are antibodies in the recipient's blood, ready to attack the donated organ.	Transplantation should not be carried out.
NEGATIVE CROSSMATCH	There is no reaction.	Transplantation is safe.

AFTER THE TRANSPLANT

The way to prevent or reduce rejection (other than getting a kidney from an identical twin) is to use immunosuppressive drugs – medicines that interfere with our immune system's ability to recognize "foreigners."

THE PROS OF TRANSPLANT

- Improved quality and length of life.
- Freedom to travel.
- Fewer dietary and fluid restrictions.
- Ability to return to work or school.
- Improved fertility.

THE CONS OF TRANSPLANT

- The patient must take daily anti-rejection medications for the rest of their life.
- Risk of rejection is always there. However, as medicines and treatment have improved, this risk has reduced considerably in recent years.
- Because the immune system is suppressed by medications, transplant recipients are more susceptible to infections and cancer.

IN FOCUS: ORGAN TRANSPLANTS
Questions for Reading Comprehension

1. Describe the concept of compatibility and the role which antigens play in its determination.
2 . In your own words, describe the process of rejection.
3. Compare blood type and tissue markers. Which is more critical for organ donation, and why?
4. Is transplant a “cure”? Why or why not?

IN FOCUS: KIDNEYS

Advanced Vocabulary
Dialysis, hemodialysis, peritoneal dialysis, directed donation, paired donation

Nationally, over 80 percent of the U.S. organ transplant waiting list is comprised of individuals waiting for a kidney transplant, due to various conditions leading to kidney failure, such as congenital kidney disease, auto-immune kidney disease, hypertension, and diabetes.

There is a chronic shortage of kidney donations in the United States. According to UNOS, the number of people waiting has increased, while the number of both deceased and living donors has remained relatively flat.

Because more people are waiting, the amount of time individuals spend on the waiting list is also rising.

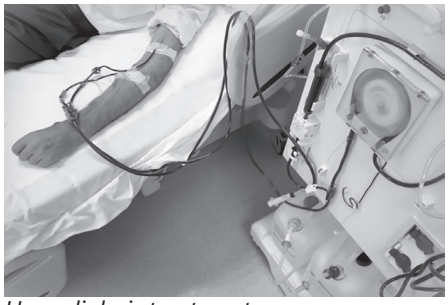
In the United States, approximately 4,500 people die while waiting for a kidney transplant each year. If you or someone you loved were diagnosed as needing a kidney transplant, what options would be available?

TREATMENT OPTIONS

When someone suffers from chronic kidney disease, their kidneys do not usually fail all at once. Kidney disease often progresses slowly, over a period of years. It is not until a person's kidney function declines to only 10 to 15 percent that life-saving treatment - either transplant or dialysis - becomes necessary. Alternatively, patients may opt for no treatment. Without treatment, survival will be limited to 1 to 2 weeks.

DIALYSIS

Unlike those who are in imminent need of a heart, lung, or liver transplant, a patient's life can be maintained through dialysis treatments. Dialysis is not a cure for those with kidney failure Dialysis performs the work of the kidneys, cleaning the patient's blood of waste and excess fluid. There are two kinds of dialysis:


Hemodialysis treatment

- **HEMODIALYSIS**
  This usually requires patients to travel to a clinic for treatment three times a week for an average of four hours each time. A patient's blood is pumped, a few ounces at a time, through a large hemodialysis machine. This machine removes toxins and excess fluid, and returns the cleaned blood to the body. There are significant dietary restrictions for those undergoing dialysis, as well as time constraints, making it difficult to work, go to school, or travel.

- **PERITONEAL DIALYSIS**
  This type of dialysis is usually done multiple times each day or overnight, and does not require the patient to go to a center. A catheter is placed inside the peritoneum, a membrane in the abdomen. Then, fluid is inserted into the membrane and "dwells" or stays there for several hours. During the dwell time excess fluid and toxins are drawn into the membrane. The fluid is then drained out through the catheter.

As you can imagine, the time and cost of long-term medical care accumulates, impacting a patient's social, emotional, financial and physical well-being. The 5-year survival rate for dialysis patients is 35.8 percent.

DECEASED KIDNEY DONATION

Patients who meet the necessary medical criteria may join the national organ transplant waiting list. They may wait days, weeks, months or years until they are matched with a deceased organ donor. Typically, the wait time ranges from between two and ten years, depending on where they live, and issues of blood and tissue compatibility.

LIVING KIDNEY DONATION

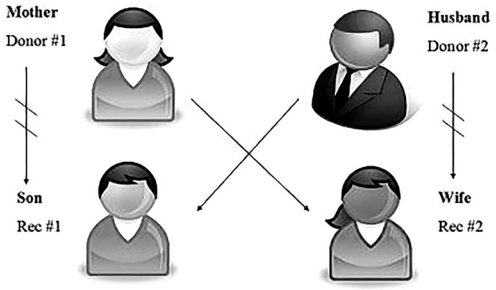
A healthy living person can donate one kidney for transplantation to another person. This eliminates the recipient's need to be placed on the national waiting list. Because the need for kidney donations is a life or death issue for so many Americans, there exist several kinds of living kidney donation programs which aim to facilitate the matching of recipients and living donors. Not all programs are available at all transplant centers.

DIRECTED DONATION

This refers to donating a kidney to someone you know, and for whom you are a blood and tissue type match: a family member, friend, coworker, neighbor, etc. The challenge with direct donation is that, in the majority of cases, direct donors are incompatible with their intended recipients.

PAIRED DONATION

If a donor and recipient do not match blood or tissue types, they can agree to "swap" with another donor/recipient pair with whom they are compatible.

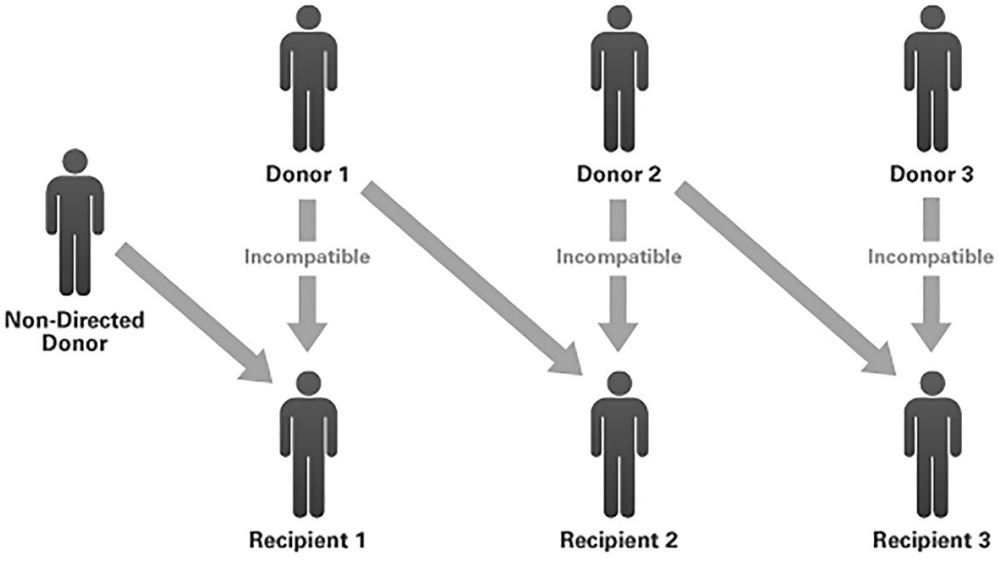


NON-DIRECTED/ANONYMOUS DONATION

If someone is not a match with their intended recipient, they may still wish to donate, and can do so to a stranger on the waiting list with whom they are a match. They could also start a donor chain (see below). The donor and recipient will remain anonymous to each other unless both parties express a desire to communicate.

DONOR CHAINS

Donor chains begin with a non-directed donor whose wish to donate initiates a string of kidney transplants for incompatible donors and recipients. Essentially, for each patient who needs a transplant, a family member, friend or acquaintance of that patient agrees to donate their kidney to someone else in need.



Images courtesy of UNOS.

IN FOCUS: KIDNEYS
Questions for Reading Comprehension

1. What are the options for someone experiencing kidney failure?

2 . What is the difference between hemodialysis and peritoneal dialysis?

3. In your own words, describe the difference between directed donation, paired donation, and non-directed donation.

IN FOCUS: CAREERS IN DONATION AND TRANSPLANTATION

Students who pursue a career in organ and tissue donation or transplantation enter one of the most rapidly changing and most challenging areas of medicine. On the following pages are brief descriptions of some of the roles different healthcare professionals play in relation to donation and transplantation. Additional careers are investigated in the remainder of this section.

CAREER	DESCRIPTION
CHEMISTS	Chemists are scientists who study chemicals and how they react with one another. Chemists can be involved in developing medications to treat organ recipients.
DIALYSIS TECHNICIANS	Dialysis technicians oversee the process of safely administering dialysis to kidney patients. Patients with failing kidneys who are waiting for a transplant must have dialysis to keep their bodies cleansed of impurities that the kidneys would normally help eliminate.
IMMUNOLOGISTS	Immunologists are medical professionals who study and research the body's immune system, and who help develop ways for the body to more effectively accept a transplanted organ with fewer side effects.
LAB TECHNICIANS	Lab technicians trained in the life sciences help catalog, store, and test tissues, blood samples, and other important information.
NEPHROLOGISTS	Nephrologists are medical doctors who specialize in kidney care and treatment.
NURSES	Nurses assist physicians in treating organ transplant recipients and donors, and assist in surgery during organ and tissue recovery and transplantation. These nurses typically have critical care experience.
NUTRITIONISTS	Nutritionists study how diet affects overall health. Nutritionists can help organ recipients maintain a diet that will help them regain their health during the recovery period and through the rest of their life.
PHARMACIST	Pharmacists work closely with a patient's medical team, the patient and family members to minimize side effects and organ rejection and maximize quality of life.
PHARMACOLOGISTS	Pharmacologists are scientists who deal with the preparation, uses, and effects of medications.
PHYSICAL THERAPISTS	Physical therapists develop and help administer exercise programs that help organ and tissue recipients recover their physical strength and resume their normal activities as much as possible.
PHYSICIANS	Physicians diagnose and treat diseases that may result in organ failure, and provide treatment and prescribe medication for individuals who are waiting for an organ transplant or have undergone organ transplantation.

CAREER	DESCRIPTION
RADIOLOGIST	Radiologists are medical professionals who understand x-rays and x-ray therapies, and who determine the best use of these technologies in the medical care of donors and transplant recipients.
RESEARCHERS	Researchers in the field of medicine – chemists, biologists, radiologists, and others with training and/or experience in the life sciences – help develop new drug treatments, methods of transplantation, and ways of treating organ recipients.
SOCIAL WORKER	Social workers work with transplant patients and living donors, to provide counseling and education, provide information on services and resources, and perform psychosocial evaluations as needed.
TRANSPLANT COORDINATORS	Transplant coordinators – a vital link in the donation and transplantation process – counsel the family of a recently deceased person about the option of donation, and help oversee the medical management of the donor and placement of the organs. They educate transplant candidates about the donation process and options.
TRANSPLANT SURGEONS	Transplant surgeons specialize in the transplantation of particular organs. They also remove organs from donors.

Adapted from U.S. Department of Health and Human Resources

For more information on careers, visit www.gorecycleyourself.com

Interviews with Local Professionals

The following are informational interviews with local professionals in the donation and transplantation field.

JUSTIN

DONATION SPECIALIST at Lions VisionGift

1. WHAT'S YOUR DAY-TO-DAY WORK LIKE?

We take calls and process cases 24/7, 365 days a year from all over Oregon, Southwest Washington, and Idaho. Donation specialists are in the building 24 hours a day, in 12 hour shifts. After Lions VisionGift has been notified of a death by a hospital, medical examiner, hospice worker, etc., I take over cases regarding potential cornea donors and coordinate what needs to be done to determine if someone is eligible to donate cornea and/or tissue and to facilitate actual donation. I check the Registry to see if a potential donor had registered with the DMV or online. I read medical records, call the donor's family, and consult with doctors.

2. WHAT SKILLS WOULD YOU SAY ARE IMPORTANT FOR YOUR JOB?

I think the biggest skill is multitasking—being able to coordinate a lot of different types of work at the same time. You might have five to seven active cases per shift, and each one of them needs your attention, such as reading electronic records sent by the hospital and getting details from the doctor to determine if someone can be a donor. A lot of the job is managing your time as well as you can, while also, during what can be a stressful time, paying close attention to detail.

3. WHERE DID YOU LEARN THE SKILLS NEEDED FOR YOUR JOB?

It helps to have a general medical background, especially courses in general anatomy, or to have had an internship in a hospital or ER. Many people in the field are at some stage of pursuing or entering medical school. But there is a lot of on-the-job learning, so above all it's important to be able to dive in and learn a lot, quickly.

4. WHAT ROLES DO SPEAKING AND LISTENING HAVE IN YOUR JOB?

People skills are important because I am talking to many different kinds of people on the phone. For example, I need to sympathize with the grieving family, for whom it might be the worst day of their life. I have to be comfortable with medical terminology, so I can speak comfortably with busy doctors and nurses, to determine if donation is possible. Meanwhile, I am also talking to a courier, trying to help them to deliver tissue.

TUCKER

RECOVERY TECHNICIAN at Lions VisionGift

1. WHAT'S YOUR DAY-TO-DAY WORK LIKE?

We first confer with the donation specialists, who coordinate donation. Recovery technicians go out into the field and actually perform the recovery. This includes a blood draw for the purpose of testing, a physical inspection to look for any contraindications to donation; then we excise the tissue. We may do some further processing when we get back to the lab. After that, there is standard paperwork, and looking more closely at the tissue we've recovered through testing and specular microscopy. Travel is common; it's not unusual to be in Astoria one day, and Pendleton the next.

2. WHAT SKILLS WOULD YOU SAY ARE IMPORTANT FOR YOUR JOB?

I have to be able to adapt quickly – to really think on my feet. A lot of times I'll be sent out on recovery and get good details from the coordinators, but they of course can't know everything that's happening on the ground. I have to be able to adapt to whatever situation I encounter. It helps to have a clinical mindset, staying focused on clinical and medical records.

As far as schooling goes, anatomy and physiology are important, as is medical terminology. Recovery technicians should also have fairly steady hands – and good attention to detail.

JOSH

PROCESSING TECHNICIAN at Lions VisionGift

1. WHAT'S YOUR DAY-TO-DAY WORK LIKE?

Processing technicians begin the day by looking at the scheduled surgeries for which we need to prepare tissue. Using instruments, we split the cornea into different thicknesses according to what a transplant surgeon has requested. For example, if the surgeon needs to replace only a diseased endothelial layer, we cut the cornea down to maybe 100 microns; the surgeons can then transplant just that healthy endothelial layer which we have prepared. Preparation is a really, really delicate procedure and it takes practice and expertise. We perform thousands a year, and this saves surgeons time in the operating room. The prepared tissue is then sent on to the surgery center.

We also do a lot of ancillary things. For example, we spend one-on-one time with corneal transplant surgeons; if they are interested in pursuing research on anything, from suturing to developing new transplant techniques, we work with them.

As a manager, I do a lot of technical writing. Because our procedures are constantly changing, I want those procedures to reflect the most accurate and efficient procedures available.

2. WHAT SKILLS WOULD YOU SAY ARE IMPORTANT FOR YOUR JOB?

Attention to detail and manual dexterity. Very fine motor skills are probably the most essential skill, just because we're dealing with such small amounts of tissue. We use an operating scope; everything is magnified so little tiny movements are very dramatic on this delicate tissue. Some of this can be taught – for example, how to rest and hold your stands so that you are as stable as possible. Being able to work well with others is important - we don't work in silos. Because we have surgeons coming in from all over the country and world to visit our facility, it is important to have interpersonal skills.

MALIA

RECOVERY COORDINATOR at Community Tissue Services

1. WHAT'S YOUR DAY-TO-DAY WORK LIKE?

Every day is different! Coordinators really have two different jobs. One is in the operating room, where we perform the donor recovery procedures. If we are on call, we may be in the operating room all day and night, because a recovery typically takes around three to five hours, depending on what grafts we are recovering. Then, there is our "desk" job, where we are obtaining medical records and getting the charts ready to send to our medical directors for transplant approval.

2. WHAT SKILLS WOULD YOU SAY ARE IMPORTANT FOR YOUR JOB?

Multi-tasking and organizational skills are probably the skills that we use most. Oftentimes, we will be in the operating room performing a recovery, while we may also be on the phone trying to work with families and screen potential donors.

We have to solve problems all the time! We are in a race against the clock. For example, Lions VisionGift may call and say, "We have a time-sensitive donor, what time do we have to get all the paperwork done?" We have to factor where the donor is, what time of day it is (does traffic matter?), what time a funeral home or the medical examiner's office might close, etc. To top it off, we may have two recovery procedures going on. It's a constant balancing act, and we do whatever it takes to make it work for every donor and their family.

WRITING SKILLS

Most of our writing is done with filling out the recovery process on the chart. We have to do a diagram of the physical exam and record every time and tissue taken.

SPEAKING AND LISTENING SKILLS

We have to communicate well with the call center at the eye bank, as well as with our coworkers. If we miss a detail or are not clear on something, we could lose the opportunity for someone to become a tissue donor.

MATH SKILLS

On every donor, we have to do an algorithm to determine how much fluid they got prior to death. We scan medical records and look for blood products and crystalloids (liters of saline, for example). Conversions of pounds to kilograms and centimeters to inches are used on a daily basis. We also have to calculate time, for example, from death to the recovery procedure.

3. WHERE DID YOU LEARN THE SKILLS NEEDED FOR YOUR JOB?

I have a Bachelor's degree in biology. That gave me a good base, but most of my profession is all on-the-job training. For example, I had to learn a lot about medical terminology! Recovery coordinators must be accredited by the American Association of Tissue Banks.

ERIN

RECOVERY COORDINATOR at Community Tissue Services

1. WHAT'S YOUR DAY-TO-DAY WORK LIKE?

There are many variables that present themselves every single day, which is just one aspect that I love about this career. From the actual cases themselves, to balancing timeframes in order to be able to recover the donors in a given day, and to being able to work on our donor charts; it is diverse every single day. The day may start out relaxing and slow, then many cases will appear and it will be an "all hands on deck" approach in order to make the recoveries a success!

2. WHAT SKILLS WOULD YOU SAY ARE IMPORTANT FOR YOUR JOB?

Multi-tasking is a must. We also all have to be problem solvers here! When one is the primary coordinator on call, one can get very overwhelmed with cases forming and keeping them separate, coordinating the travel time for the donors to arrive at the office, etc. It helps to have each other as sounding boards to problem-solve and come up with plans for the days and nights when we get busy. It is truly a team effort in this office.

READING SKILLS

I read through donor referral worksheets, medical records, and the medical/social histories of our donors. Even though I've been in tissue banking for seven years, I am still constantly teaching and re-teaching myself medical terms, as well; so I reference a lot of medical web sites.

WRITING SKILLS

During a case, we hand-write everything we observe during our physical assessment of our donors, as well as everything else that needs to be documented during the length of the entire case. After a case, we write letters to the donor's family members thanking them for the gift of donation, and letters to the donor's primary care physicians to follow-up and confirm pertinent medical history. When family members call in to find out more about recipient information on their loved ones, we will write them letters and send them tables explaining the age, gender, and type of surgery/graft utilized. Those are my favorite letters to write.

SPEAKING AND LISTENING SKILLS

Effective speaking and listening skills are important in order to convey the importance of what we do here every day, without being too harsh or reactive. I also get a chance to use my speaking skills with Donate Life Northwest! I have the chance to give presentations to high schools, and colleges. I table booths at health fairs. I get to explain the donation and registration process in ways that all audiences can understand.

MATH SKILLS

We have strict timelines in which recoveries need to commence by, so we are simply calculating times with every case in order to ensure that we are making that correct initial incision time. We serologically test each donor for infectious diseases. Depending on the weight, height, and amount of blood products and other fluids the person received before specific timeframes of death, they could be plasma-diluted, meaning their blood was too dilute to confirm the infectious diseases we tested for; so we have to confirm that they were not plasma-diluted through calculations before the tissue can be released for transplant.

3. WHERE DID YOU LEARN THE SKILLS NEEDED FOR YOUR JOB?

I first started at a tissue bank in Seattle, in distribution. Then, I became a recovery and processing technician. Next, I moved here to Portland, and became a recovery coordinator. I think it has definitely helped me a lot to have worked in three different aspects of tissue banking in order to see the bigger picture! I received my Bachelors of Science in nutrition; having the anatomy and physiology under my belt assisted a lot. Honestly, though, if someone is interested in tissue banking and has a general love and knowledge of anatomy, and being part of someone's last wish and ultimate gift, they will succeed in this job. All the training is done on the job. I also am a Certified Tissue Banking Specialist certified through the American Association of Tissue Banks.

CHRISTINE

ORGAN DONATION SPECIALIST at Pacific Northwest Transplant Bank

1. WHAT'S YOUR DAY-TO-DAY WORK LIKE?

The most common way to describe a typical workday is that there is no typical workday! We are responsible for responding to any potential organ donor within the state of Oregon, Southwest Washington and Southwest Idaho.

First we evaluate, over the phone, whether the patient meets the basic criteria* to be evaluated as a potential organ donor. If they do, we usually go to that hospital to evaluate their medical history, and to determine if they are medically appropriate to be an organ donor in the event of their death.

After the patient is declared brain dead, we approach the family to discuss the donation options. We offer the family information in a compassionate and supportive manner. We let them know that many families see this as a way for something positive to come from their loss and to help with their grief. Many of the patients have already made the decision to donate by registering as an organ and tissue donor. If a patient is a registered donor, we inform the family of their loved one's legally binding authorization for donation. The authorization for donation is completed with the family and the process of donation is explained.

As we proceed with the donation process, we evaluate all the organs – heart, liver, lungs, kidney, and pancreas. Not every organ is necessarily going to be suitable for transplant, but we evaluate each one to determine if it can be placed with a recipient. We enter the donor's age, height, weight, blood type, and the hospital location into the UNOS national computer system. This generates a computerized potential recipient list which we are obligated to follow as we offer those organs. It takes us the better part of 18-24 hours before we're then ready to coordinate one to four surgical teams to travel to the donor patient and perform the recovery surgery.

Once the transplantable organs are recovered, we coordinate the transplantation to the transplant centers. So that's a "typical" day on call! We also have days where we're not on call, but we're in the office, or out in the hospitals, educating nurses and physicians about the donation process.

*See Advanced Readings to learn more about the criteria for organ donation.

2. WHAT SKILLS WOULD YOU SAY ARE IMPORTANT FOR YOUR JOB?

The most important skill is being able to multi-task, and staying calm and focused in what is a really busy process. In between all the tasks that have to be completed, we are constantly interacting with hospital staff, and sharing as much information as we can about the donation process. Organ donation is such a rare occurrence in any hospital that we're always going to have lots of staff who want to come up and ask a question.

WRITING SKILLS

We do a lot of writing, mostly with letters and follow up. After we've finished a donor case, every staff person who was involved in the case – from the respiratory therapist to the pharmacist, to the nursing staff and the physicians – receives a follow up. We really want to recognize their effort and let them know how much we appreciate it. They helped save lives, and it would not have been possible without their efforts.

SPEAKING AND LISTENING SKILLS

This is 90 percent of the job! When we're talking with potential donor families, there's a lot of information we need to share with them, but it's equally important to really listen to them. As we are filling in the gaps of their medical history, they are sharing the story of their loved one. Yes, it's important for us to know what sort of surgeries they had, but it's equally important to know a little bit about them. It's important to let families have time to share that, to be able to listen, to give them space. This also helps them to start their grief process by sharing the story and the legacy that their loved one is leaving.

MATH SKILLS

We use a lot of everything, from plain old addition and subtraction to a lot of algebra. A lot of our job is to confirm and verify.

3. WHERE DID YOU LEARN THE SKILLS NEEDED FOR YOUR JOB?

Most of our staff has a critical care background. Most are nurses, but we also have some respiratory therapists or EMTs. I went to a nursing program that focused on collaborative learning. I was fortunate to work in intensive care units with a team approach, so everybody worked together. Working in critical care forces you to learn to prioritize what's most critical, how to think critically, and to be a continual learner. Within donation and transplant science and technology, so many things are always changing that there are several medical journals and web-based communities to keep us up to date. We have a specialty certification that requires ongoing education and has to be re-certified every three years.

DR. DOUZDJIAN

TRANSPLANT SURGEON & SURGICAL DIRECTOR at Legacy Good Samaritan Transplant Program

1. WHAT'S YOUR DAY-TO-DAY WORK LIKE?

It depends on the day. I know that on Mondays, I'll be going to the operating room, to check in on the donor surgeons performing a nephrectomy (kidney removal from a living donor). Once the kidney is available, I perform the transplant.

The second scenario – the deceased donor transplant – is much more complicated. I have no idea when or where they will occur… Typically I will get a call from Pacific Northwest Transplant Bank, saying they have a potential organ donor. If I think the kidneys are viable to transplant, we make travel arrangements for me to go perform the recovery surgery, wherever that hospital is [within Oregon, Southern Washington, or Western Idaho].

I get back on the plane, come back, and typically the nephrologist would have made arrangements for whoever will receive the kidney to come in. Patients travel in from all over. I place the kidney in the recipient as well.

When I'm not involved in transplant, my work involves taking care of all the patients that were transplanted and evaluating potential candidates.

2. WHAT SKILLS WOULD YOU SAY ARE IMPORTANT FOR YOUR JOB?

Other than the obvious skills of doing the operations for which we've trained for 20 years…! I have to be very organized. I'm always reading charts and computer screens, or writing notes into [a computer database]. When I evaluate transplant patients I must create a report that details all of their medical problems, and then all the complications we could encounter… because of the waiting list times, it may be a year or two before I see that patient for their transplant, so that when I pull up those notes they must remind me of the conclusions I drew during the evaluation.

Problem solving is a lot of my work. Every 15 minutes, a nurse will walk into my office, put a chart on my desk, and ask "what are we going to do about this patient?" The question is, is this person a candidate for transplant? Do we need more tests, and what kind?

I am part of a committee that meets weekly to review every patient's files. This team includes nephrologists, nurses, social workers, dieticians, a psychologist… There is a great deal of speaking, listening, and decision-making.

3. WHERE DID YOU LEARN THE SKILLS NEEDED FOR YOUR JOB?

A transplant surgeon first needs three or four years of undergraduate education. Then, they are accepted to four years of medical school, plus a general surgery residency… that's about five years. After that, you specialize with a transplant surgery fellowship, maybe two to three years. Then you become a transplant surgeon! From there, you must keep up your skills with continuing education in order to keep your license.