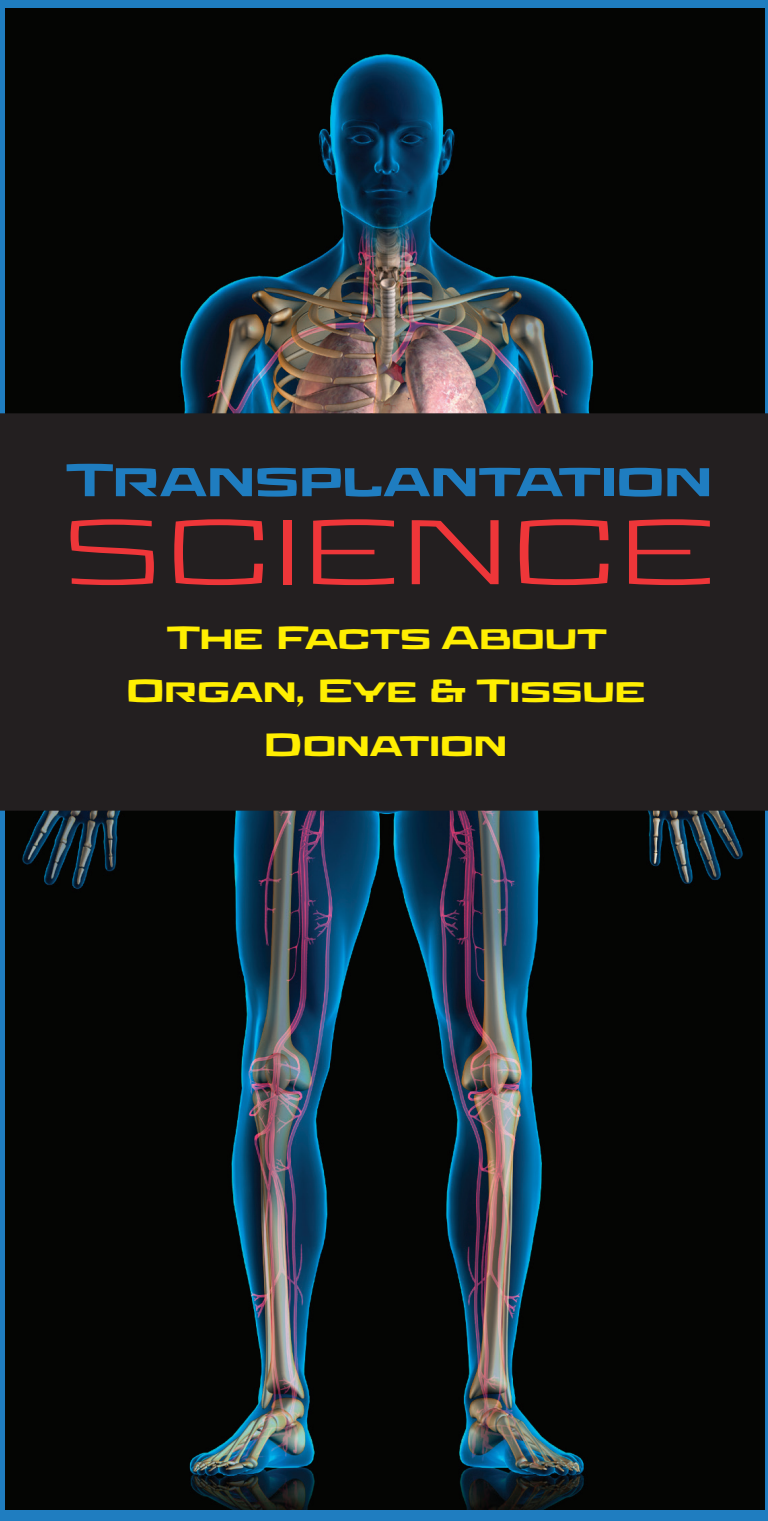
Transplantation Science

The Facts About Organ, Eye & Tissue Donation

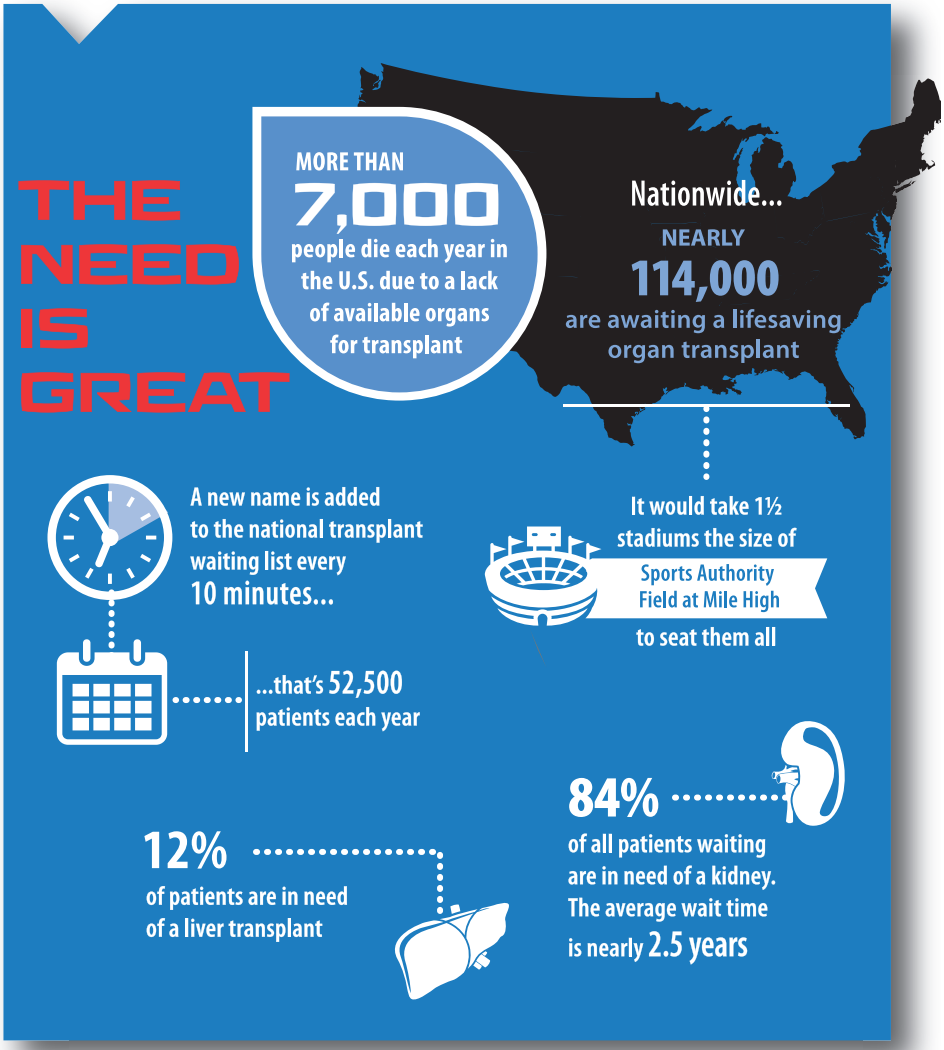
HIGH SCHOOL



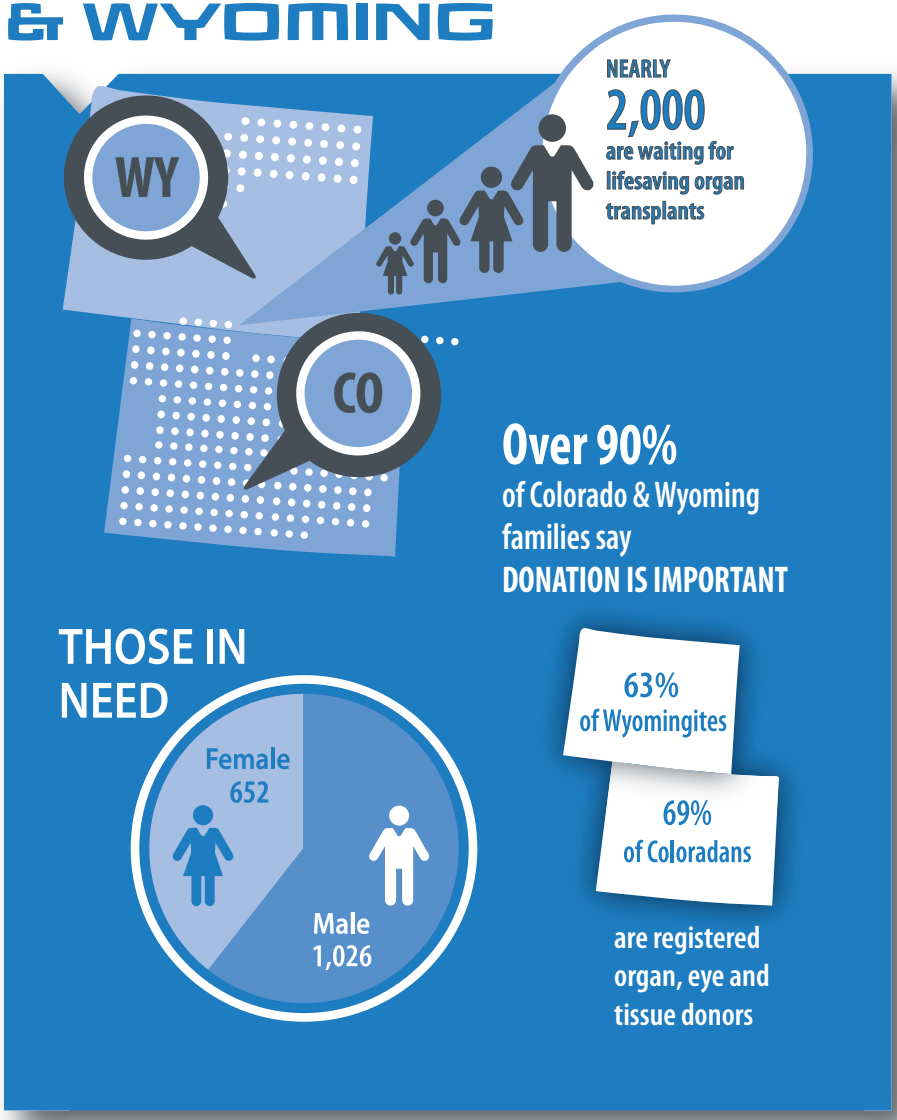
Transplantation Science

The Facts About Organ, Eye & Tissue Donation

IN THE U.S.


THE NEED IS GREAT
MORE THAN
7,000
people die each year in the U.S. due to a lack of available organs for transplant
Nationwide...
NEARLY
114,000
are awaiting a lifesaving organ transplant
A new name is added to the national transplant waiting list every 10 minutes...
...that's 52,500 patients each year
It would take 1½ stadiums the size of
Sports Authority Field at Mile High
to seat them all
84%
of all patients waiting are in need of a kidney. The average wait time is nearly 2.5 years
12%
of patients are in need of a liver transplant

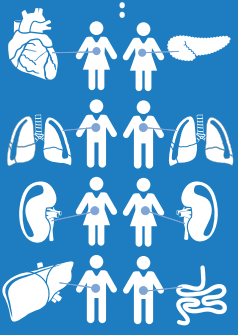
IN COLORADO & WYOMING



THE LIFESAVING IMPACT OF ORGAN, EYE & TISSUE DONATION

A single donor can...

save up to **8** lives through organ donation



save or heal more than **75** lives through tissue donation

WY CO

On average, **over 450 lives are saved each year** thanks to organ donors from Colorado and Wyoming

Approximately **125,000 lives are saved or healed** each year thanks to CO and WY tissue donors

STATION 1

ORGANS

FACTOIDS

There are six different transplantable organs:
Kidneys (2), Liver, Heart, Lungs (2), Pancreas and Intestines.

The majority of organs for transplant come from deceased donors; however, a living donor may be able to give a kidney, a part of their liver, a section of their pancreas or intestine, a part of a lobe of their lung.

Nearly **114,000** people are awaiting a lifesaving organ transplant in the United States. Nearly **2,000** people are on the waiting list in Colorado and Wyoming.

The kidney and liver are the organs most in need. As of October 2019 more than **80%** of the patients on the list are waiting for kidneys and **11%** are waiting for livers.

Every year, about **30,000** people receive lifesaving organ transplants in the United States.

How They Work

THE KIDNEYS are a pair of reddish-brown organs located on either side of the spine just below the diaphragm, behind the liver and stomach. They are bean-shaped and about 4½ inches long, 2½ inches wide and one inch thick. The primary function of the kidneys 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

Hypertension

Hypertension (HTN) or high blood pressure is a chronic medical condition in which the systemic arterial blood pressure is elevated. Hypertension is classified as either primary (essential) hypertension or secondary hypertension. About 90–95% of cases are categorized as "primary hypertension." Obesity, smoking, excessive alcohol consumption, high sodium diets and sedentary lifestyle are all factors that can lead to hypertension. The remaining 5–10% of cases (secondary hypertension) are caused by other conditions that affect the kidneys, arteries, heart or endocrine system.

Persistent hypertension is one of the risk factors for stroke, myocardial infarction, heart failure and arterial aneurysm, and is a leading cause of chronic kidney failure. An aneurysm is the widening of an artery, a vein or the heart in a specific spot. There is generally a bulge and the wall of the weakened blood vessel or organ may rupture. (*www.medicinenet.com*)

Diabetes

Diabetes is a life-long disease in which the body does not produce or properly use insulin. Insulin is a hormone produced by the pancreas that is needed to convert carbohydrates and other food into energy needed for daily life.

The three main types of diabetes are:

- **Type 1 Diabetes**
- **Type 2 Diabetes**
- **Gestational Diabetes**

Type 1 Diabetes

Type 1 diabetes, often diagnosed in children and young adults, is an autoimmune disease in which the body does not produce insulin. Therefore, a person who has type 1 diabetes must take insulin daily to live.

Symptoms of type 1 diabetes usually develop over a short period. Symptoms include increased thirst and urination, constant hunger, weight loss, blurred vision and extreme fatigue. If not diagnosed and treated with insulin, a person with type 1 diabetes can lapse into a life-threatening diabetic coma, also known as diabetic ketoacidosis.

Type 2 Diabetes

Typically occurring in adulthood, type 2 diabetes is the most common form. About 90 to 95 percent of people with diabetes have type 2. This form of diabetes is associated with older age, obesity, family history of diabetes, previous history of gestational diabetes, physical inactivity and ethnicity.

The primary function of the kidneys is to remove waste from the body through the production of urine.

When type 2 diabetes is diagnosed, the pancreas is usually producing enough insulin, but for unknown reasons, the body cannot use the insulin effectively, a condition called insulin resistance. After several years, insulin production decreases. The result is the same as for type 1 diabetes: glucose builds up in the blood and the body cannot make efficient use of its main source of fuel.

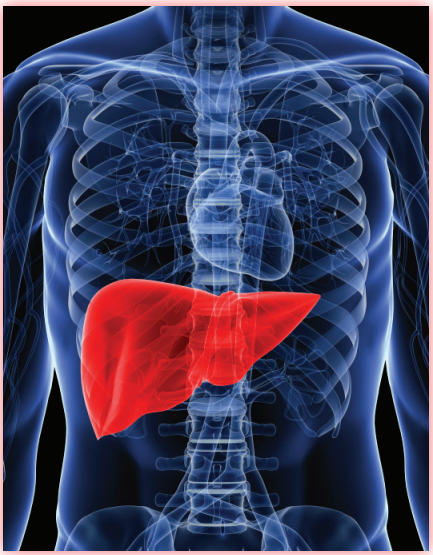
Unlike type 1 diabetes, the symptoms of type 2 diabetes develop gradually. Symptoms may include fatigue or nausea, frequent urination, unusual thirst, weight loss, blurred vision, frequent infections and slow healing of wounds or sores. Some people do not have any symptoms. Type 2 diabetes occurs more often in African Americans, American Indians, Hispanic Americans, and among women with a family history of diabetes.

Gestational Diabetes

Gestational diabetes develops only during pregnancy. Women who have had gestational diabetes have a 20 to 50 percent chance of developing type 2 diabetes within 5 to 10 years.

autoimmune disease: a disease that results when the body's system for fighting infection turns against a part of the body

How it Works



THE LIVER is one of the largest and most complex organs in the body. It weighs about 3.3 pounds in adults and is made up of a spongy mass of wedge-shaped lobes. The liver has numerous functions that are necessary for life. 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.

The liver makes the factors that the blood needs for clotting. It also secretes bile to help digest fats, and breaks down toxic substances in the blood such as drugs and alcohol. The liver is also responsible for the metabolism of most drugs.

Common Diseases That May Lead to Transplantation

Cirrhosis

Cirrhosis refers to scarring of the liver. Scar tissue forms because of injury or long-term disease. It replaces healthy tissue. Scar tissue cannot do what healthy liver tissue does – make protein, help fight infections, clean the blood, help digest food and store energy for when you need it. Scar tissue also blocks the normal flow of blood through the liver. Causes of cirrhosis of the liver include Hepatitis C infection and long-term alcohol abuse.

Primary Biliary Cholangitis

Primary biliary cholangitis, often abbreviated PBC, is an autoimmune disease of the liver marked by the slow progressive destruction of the small bile ducts (bile canaliculi) within the liver. When these ducts are damaged, bile builds up in the liver (cholestasis) and over time damages the tissue. This can lead to scarring, fibrosis and cirrhosis. PBC affects women (usually 35-60 years old) 10 times more often than men. (sources: *http://pbcers.org; https://my.clevelandclinic.org*)

Hepatitis

Hepatitis is defined as inflammation of the liver. It is characterized by the destruction of a number of liver cells and the presence of inflammatory cells in the liver tissue.

Hepatitis can be divided into two subgroups according to its duration:

- **Acute Hepatitis** - lasting less than six months
- **Chronic Hepatitis** - lasting longer than six months

Hepatitis A virus is an inflammation of the liver from the hepatitis A virus. The virus is mostly found in the stools and blood of an infected person about 15-45 days before symptoms occur and during the first week of illness. Hepatitis A is most commonly transmitted by ingesting food or water contaminated by infected feces (fruits, vegetables, shellfish, ice and water are common sources). Hepatitis A doesn't usually lead to liver failure.

The liver is the only organ that will, over time, completely regenerate to its original shape and size.

Hepatitis B is the inflammation of the liver due to infection with the hepatitis B virus (HBV). Hepatitis B infection can be spread through having contact with blood, semen, vaginal fluids, and other body fluids of someone who already has a hepatitis B infection. Blood transfusions, tattoo or acupuncture with unclean needles or instruments, shared needles during drug use and shared personal items can transmit the virus. HBV can also be passed to an infant during childbirth if the mother is infected.

Hepatitis C is a blood-borne infection of the liver caused by the hepatitis C virus (HCV). Hepatitis C is one of the greatest causes of chronic liver disease in the United States. Unrelated to any of the other known hepatitis viruses (A, B, D and E), Hepatitis C causes damage to the liver that may lead to permanent damage as well as cirrhosis, liver cancer and even failure.

HCV can occur in individuals who have contracted it sexually, through blood transfusions or shared needles during drug use.

Sclerosing Cholangitis

Sclerosing Cholangitis refers to swelling, scarring and destruction of the bile ducts inside and outside of the liver. While the cause is often unknown, the disease is often found in patients who have inflammatory bowel disease, chronic pancreatitis and other autoimmune disorders. This disorder is rare in children and occurs more often in men.

inflammation: irritation and swelling

Common Diseases (continued)

Birth Defects

Biliary Atresia is a rare condition in which the bile ducts are blocked or have developed abnormally to obstruct flow of bile in infants. Symptoms of the disease appear or develop about two to eight weeks after birth and include yellowing of the skin and eyes, dark urine and pale, white or gray-colored stools.

Choledochal Cysts are malformations of the hepatic duct that can obstruct flow of bile in infants. Symptoms include yellowing of the skin and eyes, dark urine and pale, white or gray-colored stools.

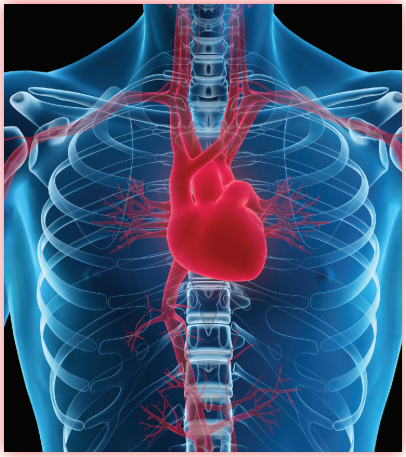
Split Liver Donation

In a split liver transplant, a liver from a deceased donor can be divided into two segments for transplantation into two different recipients, thus increasing patient access to available organs. Often a child or young adult receives a smaller segment; the larger segment may be transplanted into an adult.

This practice started in 1984 in an attempt to reduce the number of pediatric patients dying while waiting for a lifesaving transplant due to a shortage of pediatric donors. Since this innovation in transplantation the risk of death among patients on the pediatric wait list has substantially declined due to the ability to use these reduced-size grafts. Additionally, increased public education and awareness today have resulted in more liver transplants from living donors. This means that even more lives are saved and fewer people are waiting for a liver transplant.

Anyone can register to be an organ, eye and tissue donor regardless of age, race or medical history.

How it Works



THE HEART is a muscular organ that is about the size of an adult fist. It pumps blood throughout the body and is located behind the breastbone between the lungs. Deoxygenated blood flows from the heart to the lungs where it gives up carbon dioxide and is freshly oxygenated. From there, the blood returns to the heart and is pumped to the rest of the body.

Common Diseases That May Lead to Transplantation

Coronary Heart Disease

Coronary heart disease, also commonly called coronary artery disease, is a narrowing or blockage of the coronary arteries that provide the heart muscle with blood. Causes of coronary heart disease include but are not limited to: elevated cholesterol, high blood pressure, family genetics, obesity, smoking and a sedentary lifestyle.

The disease occurs when these arteries become hardened and narrowed. The arteries harden and narrow due to buildup of a material called plaque on their inner walls. The buildup of plaque is known as atherosclerosis.

As the plaque increases in size, the insides of the coronary arteries get narrower and less blood can flow through them. Eventually, blood flow to the heart muscle is reduced, and the heart muscle is not able to receive the amount of oxygen it needs.

Cardiomyopathy

Unlike heart disease due to heart attacks, where there is a problem with adequate blood flow to the heart, cardiomyopathy is a disease of the heart muscle itself.

There are many causes of cardiomyopathy, which may include coronary artery disease, heart valve disease and, although rare, viruses. It can also develop following pregnancy.

Cardiomyopathy occurs in three major types: dilated, hypertrophic and restrictive. All of these affect the heart's ability to pump blood and deliver it to the rest of your body.

How They Work

THE LUNGS are a pair of highly elastic and spongy organs in the chest. They are the main organs involved in breathing. The lungs take in air from the atmosphere and provide a place for oxygen to enter the blood and for carbon dioxide to leave the blood. The lungs are divided into sections called lobes, with three on the right and two on the left.

Common Diseases That May Lead to Transplantation

Pulmonary Fibrosis

There are two types of Pulmonary Fibrosis: Pulmonary and Idiopathic Pulmonary Fibrosis (IPF). Pulmonary Fibrosis can be caused by long-term smoking. IPF is a debilitating disease characterized by scarring or thickening of tissues deep in the lung.

IPF belongs to a family of approximately 200 related diseases, called interstitial lung diseases (ILDs), that have similar characteristics and can result in scarring.

IPF gradually interferes with a person's ability to breathe. It causes shortness of breath and is usually associated with a dry cough. The disease progresses over time, leading to an increase in lung scarring and a worsening of symptoms.

Cystic Fibrosis

Cystic fibrosis (CF) is a life-threatening disorder that causes severe lung damage and nutritional deficiencies.

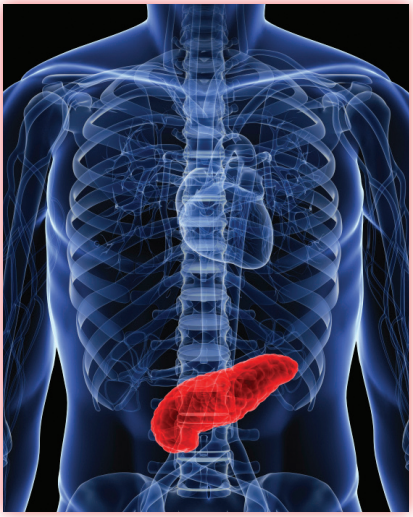
An inherited disease, cystic fibrosis affects the cells that produce mucus, sweat, saliva and digestive juices. Normally, these secretions are thin and slippery, but in cystic fibrosis, a defective gene causes the secretions to become thick and sticky. Instead of acting as a lubricant, the secretions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

Respiratory failure is the most dangerous consequence of cystic fibrosis. Also, the secretions block pancreatic enzymes that help digest fats and proteins, and they prevent the body from absorbing key vitamins.

PANCREAS

How it Works

THE PANCREAS is a five-to-six inch gland located behind the stomach. The pancreas produces enzymes that are used for digestion, and insulin, which is essential for life because it regulates the use of blood sugar throughout the body.



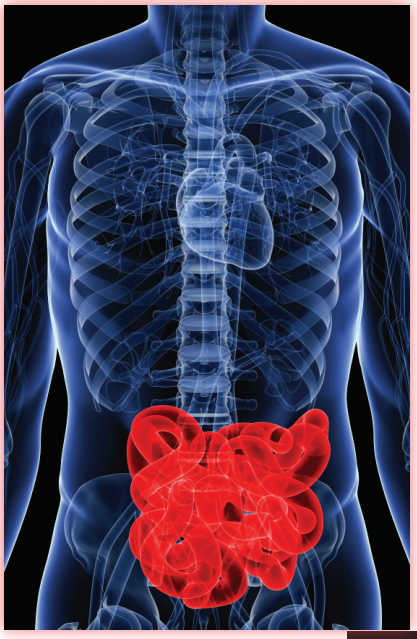
Common Diseases That May Lead to Transplantation

DIABETES (usually Type I)
See page 8 for a definition of diabetes.

INTESTINE

How it Works

THE INTESTINES make up the lower part of the digestive tract. It extends from the stomach to the anus. The upper part, the small intestine, is narrow and intricate. It provides further digestion of food and absorbs nutrients from the digested food. The lower part, the large intestine, is wider and reabsorbs water from the digested foods and sends it back into the blood stream.



Common Diseases That May Lead to Transplantation

Various conditions that cause mal-absorbtion can lead to transplantation. These are mostly present in pediatric cases, occasionally in adults.

LIVING DONATION

WHO CAN BE A LIVING DONOR?

While many people are willing to be living donors, not everyone meets the criteria.

Each potential donor is evaluated by a physician prior to surgery. The donor must be physically and psychologically fit and free from ailments such as high blood pressure, diabetes, cancer, kidney disease and heart disease.

Individuals considered for living donation are generally between the ages of 18 and 60. Gender and race are not factors in determining a successful match between a donor and recipient.

WHAT CAN BE DONATED?

Kidneys are the most common organ donated by living donors. Other organs that can be donated include a lobe of a lung, partial liver, partial pancreas, or partial intestine.

Although the decision to become a living donor involves careful consideration, it offers patients an alternative to waiting on national transplant waiting lists for an organ from a deceased donor. **While not everyone can be a living donor, anyone can sign up to be an organ and tissue donor after death.**

TYPES OF LIVING DONATION

Since living donation began in 1954 it has evolved into three types:

- **Related:** Blood relatives of transplant candidates including brothers, sisters, parents, children (over 18 years of age), aunts, uncles, cousins, half-brothers, half-sisters, nieces and nephews.
- **Non-Related:** Individuals not related by blood to transplant candidates, including spouses, in-law relatives, close friends, co-workers, neighbors or other acquaintances.
- **Non-Directed:** Individuals who are not related to or known by the recipient. This type of donation is referred to as anonymous or altruistic.

INTERESTING TO KNOW

- When a person donates a kidney, the remaining kidney will enlarge slightly to do the work of two healthy kidneys.
- The liver has the ability to regenerate and regain full function in both the donor and the recipient.
- Lungs and pancreas do not regenerate, but donors typically have no problems with reduced function.
- Generally, living donors may resume their normal activities within two to six weeks.
- Donations of blood and marrow are also lifesaving gifts, but they are not a part of organ and tissue donation.

HOW CAN I HELP?

Glad you asked...

Take these two simple steps to ensure your wish to become an organ, eye and tissue donor is realized:

Tell your family and friends about your decision.

Designate your decision. Sign up to be an organ, eye and tissue donor by saying YES when obtaining/ renewing your driver permit, driver license or state ID or anytime online:

DonateLifeColorado.org or
DonateLifeWyoming.org

TRANSPLANTABLE ORGANS

I. GOAL: Discover and identify each of the six transplantable organs.

DIRECTIONS

1. **TURN to pages 5-13 in this handbook and read about each of the organs that can be transplanted.**
2. **LOOK at the specimens or models at this station.**
3. **MATCH the name of the organ with its function in the body.**
4. **WRITE the letter of the best choice in the line provided.**

A. Intestines B. Liver C. Lungs D. Heart E. Pancreas F. Kidneys

_____ These filter waste products from the blood and turn it into **urine.** There are two of them.

_____ This **cleans** the blood of poisons and toxins (like drugs and alcohol) and also makes bile to aid in the digestion of food. It is the largest internal organ in the body.

_____ These bring **oxygen** into the blood and remove carbon dioxide. There are two of these.

_____ This **pumps** blood to all the cells in the body.

_____ This small organ makes digestive enzymes and an essential chemical called **insulin**, which keeps blood sugar at the correct levels.

_____ This is responsible for **absorbing** nutrients from digested food.

II. GOAL: Identify the transplantable organ(s) that may be necessary to treat certain common diseases to extend life.

DIRECTIONS

By drawing arrows, match the correct organ to the disease that could lead to transplant.

Diabetes	HEART
Hepatitis	KIDNEY
Hypertension	LUNG
Cardiomyopathy	LIVER
Cirrhosis	PANCREAS
Coronary Disease	
Cystic Fibrosis	
Pulmonary Fibrosis	

III. GOAL: Discover which organs you can donate while still living.

DIRECTIONS

1. TURN to page 14 in this handbook and read about living donation.
2. WRITE the answers in the lines provided.

Which one whole organ can you donate, and still live a healthy life without it?

1. _____

Why?_____

Which four organs can you donate a part of and still live a healthy life?

1._____

2._____

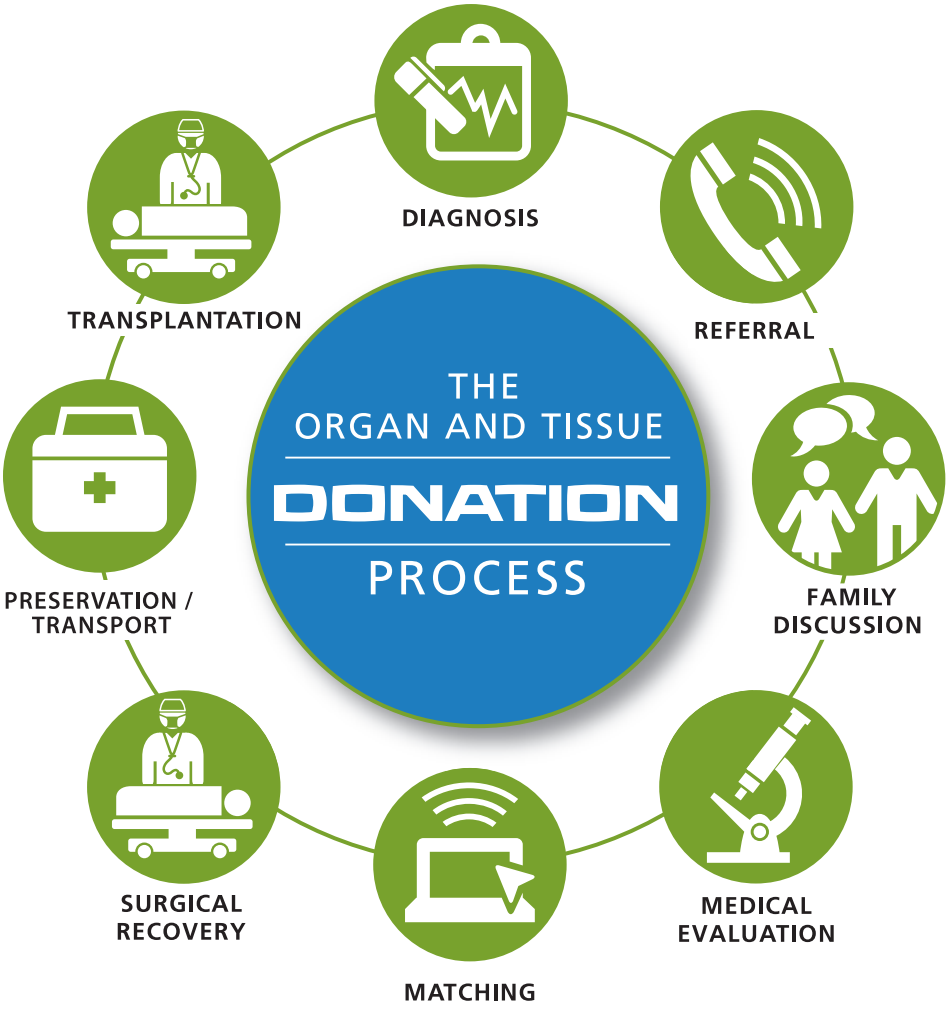
3._____

4._____

IV. Goal: Determine whether each of the following statements is true or false.

DIRECTIONS
Using the information provided on pages 5 through 14 to guide you, circle whether each statement is true or false.

One organ donor can save up to eight lives through organ donation.	**TRUE**	**FALSE**
The liver is the only organ that can completely regenerate.	**TRUE**	**FALSE**
The majority of organs for transplant are donated by living donors.	**TRUE**	**FALSE**
The heart is the organ most people on the waiting list need.	**TRUE**	**FALSE**
Many different diseases, both genetic and lifestyle-related, can cause organ failure and lead to the need for a transplant.	**TRUE**	**FALSE**


THE
ORGAN AND TISSUE
DONATION
PROCESS
DIAGNOSIS
REFERRAL
FAMILY
DISCUSSION
MEDICAL
EVALUATION
MATCHING
SURGICAL
RECOVERY
PRESERVATION /
TRANSPORT
TRANSPLANTATION

STATION 2

ORGAN DONATION & TRANSPLANT PROCESS

The Organ Procurement Organization

Prior to 1984 and the passage of the National Organ Transplant Act (NOTA), organ donation and transplantation and organ procurement were local or regional endeavors. Transplant centers either recovered organs from patients at their facility or through connections with donor hospitals based on relationships between doctors or geography. With increasing need for organs and medical advancements, transplantation has become a reality for more people and patients are living longer and achieving far better health post-transplant.

In 1984, NOTA was signed into law creating the national Organ Procurement and Transplantation Network (OPTN) for matching donor organs to waiting recipients. The OPTN includes all Organ Procurement Organizations (OPOs) and transplant centers and is managed by the United Network for Organ Sharing (UNOS). The OPTN standardized the process through which organs are donated and shared across the country as well as created the system of OPOs that are federally-designated and serve communities in specific areas in the country.

Diagnosis

Organ Donation After Brain Death

According to the Uniform Determination of Death Act, brain death is defined as the irreversible cessation of all functions of the entire brain, including the brain stem. Brain death determination is rare and occurs only in about one out of every 100 hospital deaths. It is the primary cause of death resulting in organs for transplant.

Organ, eye and tissue donation does not become an option until death has been declared.

Organ Donation After Circulatory Death

Organ donation after circulatory death (DCD) occurs when a patient has an illness from which they cannot recover and is being kept alive by artificial means, including ventilators and supportive drugs. The patient is not brain dead, but has no hope of recovery.

If the family is interested in donation and has made the decision to withdraw treatment, that process will occur in the operating room instead of the hospital room. The time from the family authorizing the process to the withdrawal of treatment is typically no less than eight hours, because of blood tests and other arrangements that must be made.

Once in the OR, if the patient's heart stops within the designated time frame for donation, the team waits for several minutes to ensure that the heart has ceased functioning. At this time, a physician from the hospital, ***not the organ recovery team***, will pronounce the patient dead. Then, the surgery to procure the organs for donation begins.

While DCD increases the number of organs available for transplant, this type of donation does not allow for organs other than the liver and kidneys to be procured in most cases. It is rare for the heart and lungs to be recovered.

The donor and family are treated with the utmost care, respect and dignity throughout the donation process.

The Referral Process

When a patient arrives at a hospital with a severe brain injury and meets certain defined clinical triggers, the hospital critical care staff contacts the local OPO as required by the Joint Commission and Centers for Medicare and Medicaid Services (CMS) on all deaths and imminent deaths.

While the hospital continues lifesaving efforts, the OPO determines medical suitability and whether the patient is a registered organ, eye and tissue donor. The OPO and the hospital staff collaborate to ensure that the family is cared for and offered the appropriate donation option should death be declared.

Unless the family brings up donation first, it is only after the family has been informed of the patient's imminent death and the patient is evaluated for medical suitability, that opportunity to donate is discussed.

Family Discussion

Donor Designation in Colorado & Wyoming

The Uniform Anatomical Gift Act (UAGA) established "first person authorization," meaning that when an individual makes the decision to donate organs and tissues after death and documents that decision, it cannot be overturned. When someone adds their name to the Donate Life Colorado or Donate Life Wyoming Organ and Tissue Donor Registry, this indicates their decision to be a donor on a document of gift. This document is legally binding, relieving the family of the burden of having to make a decision about donation.

Authorized organ and tissue donation personnel search the registry database whenever they are notified that a potential donor faces imminent brain death or has died. If the eligible donor is identified as a registered donor, the family is notified of their loved one's donor designation status.

Written Authorization

If the patient is not a registered donor, the family considers the donation options and the donation process proceeds only after the family has granted authorization. This is conducted in the hospital and involves a conversation about donation and written signature by the legal next of kin.

Medical Evaluation

Organ donor management is a complex highly-specialized area of medical practice. The process begins with Donor Alliance's evaluation of a potential organ donor, assessing function of all organs and insuring medical suitability.

Improving organ function to maximize the gift of transplantable organs is vital. Even a single organ that is made available for transplant can save a life. This makes donor management and organ optimization of the utmost importance as staff focuses on keeping the patient stable, organs functioning and able to be transplanted.

Once care needs are determined, all procedures and medications necessary to assist with organ function are provided. This can include electrolyte replacement, blood replacement, advanced imagery and diagnostic procedures as well as minor surgical procedures. The donor is kept on ventilated support while all necessary tests and procedures are completed. Care is continued while the donor is scheduled for the surgical operation to recover organs.

MATCHING

Under contract with the U.S. Department of Health and Human Services' Health Services & Resources Administration (HRSA), the United Network for Organ Sharing (UNOS) maintains a centralized computer network called UNet. Transplant professionals can access this computer network 24 hours a day, seven days a week. Generally, organs are offered first to the sickest patients within the same region. If there are no eligible recipients in that region, the organs will be offered to candidates in other regions.

UNet electronically links all transplant hospitals and organ procurement organizations in a secure, real-time environment. It allows access to all transplant professionals at any time.

Matching Donated Organs with Transplant Candidates

When a deceased organ donor is identified, a donor coordinator from an OPO accesses the UNet system and enters medical information about the donor including height, weight, blood type, lab values and genetic matching (called HLA matching). The system uses this information to match the medical characteristics of the candidates waiting against those of the donor. The system then uses a computer algorithm to generate a ranked list of patients who are suitable to receive each organ. This list is called a "match run."

Factors affecting ranking may include:

- **Tissue match**
- **Blood type**
- **Length of time on the waiting list**
- **Immune status, i.e. does the candidate have an active infection or virus**
- **Distance between the potential recipient and the donor**
- **Degree of medical urgency *(for heart, liver, lung and intestines)***

The Steps of the Matching Process

1. When an organ becomes available, the OPO managing the care of the donor inputs information about the donor into the UNet system. This information includes organ size and condition, blood type and tissue type, location, etc.

2. The UNOS computer database generates a list of potential transplant candidates who have compatibility with the donor, i.e. height, weight, blood type, and genetic matching. The computer ranks candidates by this biologic information as well as location, current medical state and time on the waiting list.

3. The transplant center representing the first person on the list is notified of the available organ. Organ placement specialists at the OPO or the UNOS Organ Center contact the centers whose transplant candidates appear on the local list.

4. The transplant team considers the organ for the transplant candidate. When the transplant team is offered an organ, it bases its acceptance or refusal of the organ upon established medical criteria, organ condition, candidate condition and organ transportation. By national policy, the transplant team has only one hour to make its decision. At times, the top transplant candidate's team will not accept the organ for one of several reasons. When a candidate is selected, they must be available, healthy enough to undergo major surgery and willing to be transplanted immediately.

5. The organ is accepted or declined by a transplant center. If the organ is refused for any reason, the OPO contacts the transplant center of the next transplant candidate on the list. The process continues until a match is made. Once a candidate is selected and informed and all testing is complete, surgery is scheduled and the transplant takes place.

ORGAN ALLOCATION

Factors In Organ Allocation

from https://unos.org/transplant/how-we-match-organs/

Blood type and other medical factors weigh into the allocation of every donated organ, but each organ type has its own individual distribution policy, which reflect factors that are unique to each organ type.

HEART ALLOCATION

- Medical Urgency
- Distance from donor hospital
- Pediatric status
- Transplanted within 4-6 hours of recovery

LUNG ALLOCATION

- Survival benefit
- Medical urgency
- Waiting time
- Distance from donor hospital
- Pediatric status
- Transplanted within 4-6 hours of recovery

All candidates waiting for a single lung or a double lung transplant are listed together.

LIVER ALLOCATION

- Medical Urgency (based on Model for End-Stage Liver Disease or MELD mortality risk score)
- Distance from donor hospital
- Pediatric status
- Transplanted within 8-12 hours of recovery

SMALL INTESTINE ALLOCATION

- Medical Urgency
- Donor/recipient immune system compatibility (factors include height, weight, blood type)
- Distance from donor hospital
- Pediatric status
- Transplanted within 8-12 hours of recovery

PANCREAS ALLOCATION

- Waiting time for isolated pancreas, kidney-pancreas combination or a combined solid organ-islet transplant from the same donor.
- Medical urgency
- Donor/recipient immune system compatibility (factors include tissue match, blood type, blood antibody levels)
- Distance from donor hospital
- Pediatric status
- Transplanted within 12-18 hours of recovery

KIDNEY ALLOCATION

- Waiting time
- Donor/recipient immune system compatibility (factors include tissue match, blood type, blood antibody levels)
- Prior living donor
- Distance from donor hospital
- Survival benefit
- Pediatric status
- Transplanted within 24-36 hours of recovery. Kidney can remain viable up to 72 hours post recovery if stored on a specially designed pump system.

The pump system that keeps a kidney viable for up to 72 hours is made possible by a process known as "perfusion." This pumps a physiological solution through the organ ensuring better preservation of the organ's quality.

ORGAN ALLOCATION

Surgical Recovery

Once all transplantable organs have been matched with recipients, an Organ Recovery Coordinator (ORC) schedules the surgical recovery with the transplant teams. In most cases, the transplant surgeons will travel to the hospital where the recovery will take place or the Donor Alliance Recovery Center. Before beginning the surgical process, the ORC will share a moment of honor written by the family with the recovery team. Once the surgery starts, the surgeons will take about three hours to recover the organs.

Preservation/Transport

Once the organs have been recovered, the clock starts ticking and organs have to be treated with great care. An Organ Recovery Specialist (ORS) will package and label each organ in a very specific way and place them on ice for preservation. The ORC and ORS double check to make sure the cooler is packaged and labelled appropriately. Most organs travel to the hospital of the waiting recipient with the recovering surgeon and are then given to the surgeon(s) who will be performing the transplant(s).

Transplantation

Once the transplant surgeon receives the organ, they will perform a final inspection prior to transplanting it to ensure it is suitable for the recipient. After the transplant surgery, the recipient is taken to the ICU to recover and then sent home a few days later. It will take healthy living, follow-up doctor appointments and some medications, called immuno-suppressants, to ensure that the organ functions properly throughout the rest of the recipient's life.

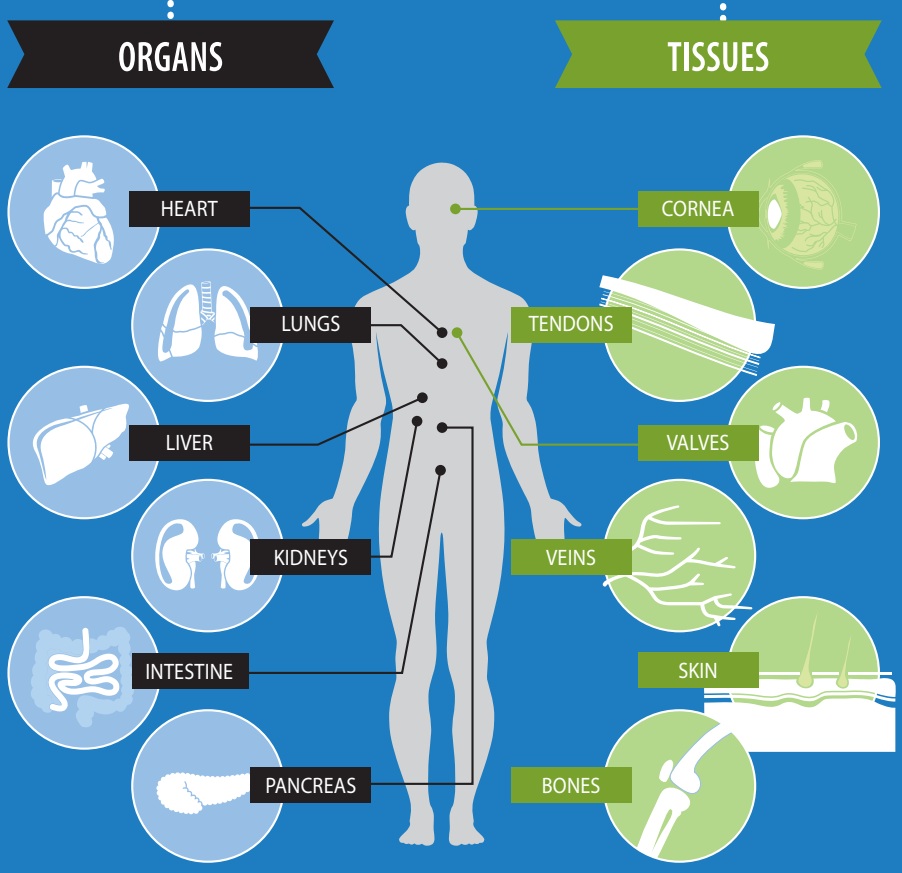
An individual's donation status does not affect medical care. The first priority of medical professionals is to save lives.

For more information about transplantation in Colorado and Wyoming, please visit the websites of our Transplant Centers:

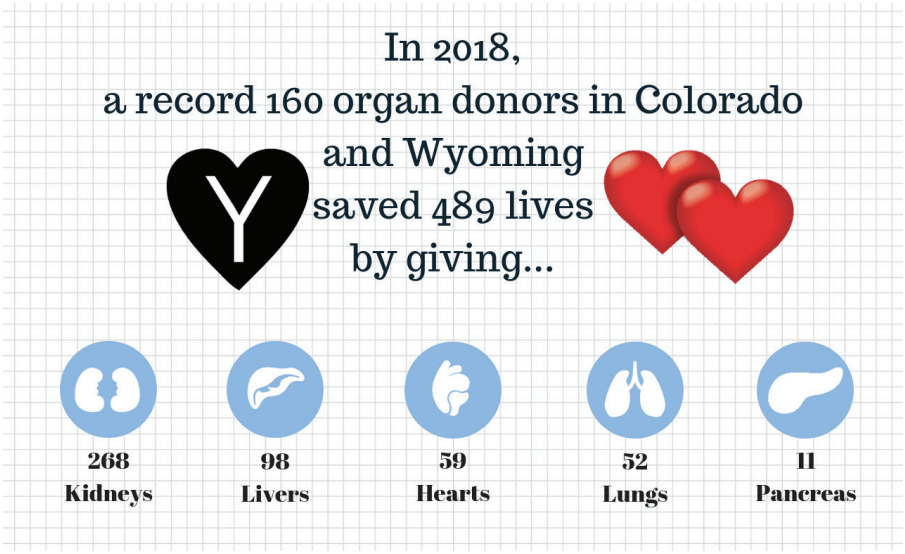
Porter Adventist Hospital	*https://www.centura.org/locations/porter-transplant*
Children's Hospital Colorado	*https://www.childrenscolorado.org/doctors-and-departments/departments/transplant/*
Presbyterian/St. Luke's Medical Center	*https://pslmc.com/specialties/transplant-services/*
UCHealth University of Colorado Hospital	*https://uchealth/services/transplant-services/*

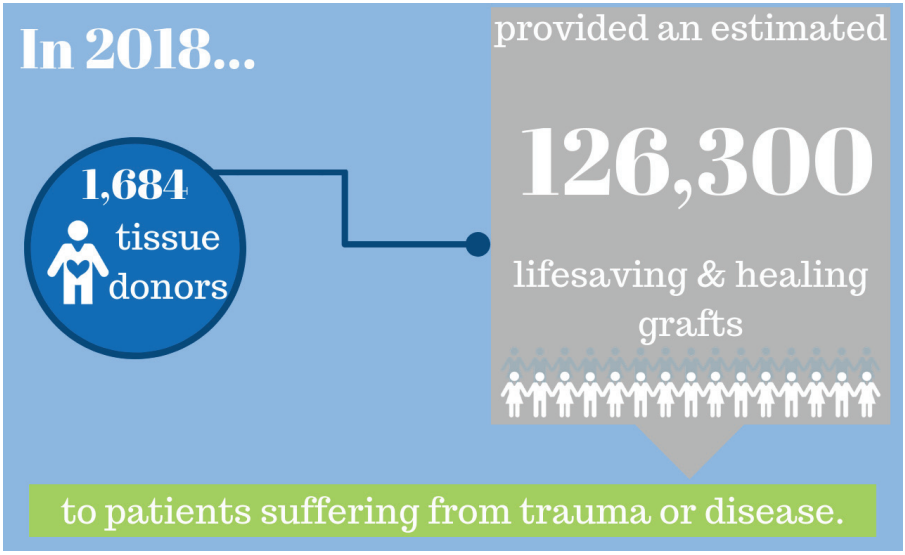
LIFESAVING & HEALING ORGANS & TISSUES

Each of these can save or heal a life.




92,910
Kidneys
1,614
Kidney &
Pancreas
13,200
Livers
WAITING
LIST
113,452*
*numbers change every day
817
Pancreas
3,759
Hearts
232
Intestines
1,434
Lungs
44
Heart & Lung


In 2018,
a record 160 organ donors in Colorado
and Wyoming
saved 489 lives
by giving...
268
Kidneys
98
Livers
59
Hearts
52
Lungs
11
Pancreas


In 2018...
1,684
tissue
donors
provided an estimated
126,300
lifesaving & healing
grafts
to patients suffering from trauma or disease.

EXERCISE

DIRECTIONS
Use the information about the organ donor and the criteria below to determine the best match for the donor heart. Base your decision upon science, not emotion.

BACKGROUND OF DONOR

A young man who lives in Denver, Colorado suffers a brain injury caused by a motorcycle accident. He is pronounced brain dead at a local hospital and his heart is now available for transplant. He is 30 years old, 6 feet tall, approximately 155 pounds. You have 6 people who are potential matches to the donor. Using the criteria listed below, determine which candidate is best one to receive this heart.

CRITERIA

❱ **Height and weight** (body size)
Are there any candidates that are simply the wrong size to receive this organ? If so, you must rule them out and they must continue to wait for a better match.

REMEMBER: A person's heart is roughly the size of their closed fist. Imagine how large each of the candidates hearts would be. The size of the heart they receive must be a close match for a successful transplant.

❱ **Age**
Are the remaining candidates too young or too old to receive this organ? If so, you must rule them out and they must continue to wait for a better match.

REMEMBER: A person is never too old or too young to donate or receive a transplant. Doctors will do their best to match the age of the recipient with the donor.

❱ **Geographic location**
Look at the region map on page 30 and determine which region the donor is in. Do all your remaining candidates live in the same or close region? If not, they must wait for a heart to become available in their region.

REMEMBER: A heart must be transplanted within 4-6 hours of recovery.

❱ **Current state of health**
Are all of the remaining candidates healthy enough to endure the transplant procedure? If they aren't, they must continue to wait.

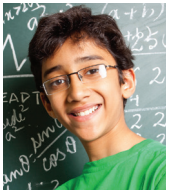
REMEMBER: A person who has an active infection would be considered high risk for receiving a transplant and be temporarily removed from the waiting list. Once the infection has been successfully treated, the patient could again be listed for transplant.

❱ **Urgency of need** Of the remaining candidates, who will receive the heart?

STATION 2 ACTIVITIES

The names and photos of all of the people below have been changed to protect their identities.

STEVEN



AGE: 14 years old
HEIGHT: 5'8"
WEIGHT: 140 lbs.
LIVES IN: Galveston, TX

PERSONAL INFORMATION:

- Freshman at Galveston Central High School
- Member of the tennis team and drama club
- Has 10-year-old twin sisters
- Parents both work at Wal-Mart
- Has damaged heart valves from a strep infection when he was little
- Has been on the Transplant Waiting List for 3 months

DEBBIE

AGE: 31 years old
HEIGHT: 5'6"
WEIGHT: 154 lbs.
LIVES IN: Cheyenne, WY

PERSONAL INFORMATION:

- Mother
- Husband works in sales and travels 3-4 days per week
- Must pay a Home Health Aide to help care for home and children when husband is away
- Has an enlarged heart
- Has been on the Transplant Waiting List for 5 months

DAVID

AGE: 40 years old
HEIGHT: 6'2"
WEIGHT: 220 lbs.
LIVES IN: Denver, CO

PERSONAL INFORMATION:

- Firefighter for 18 years
- Volunteers in a homeless shelter
- Likes bicycling and snowboarding with his girlfriend
- He is currently being treated with antibiotics for a blood infection
- Has been on the Transplant Waiting List for 6½ months

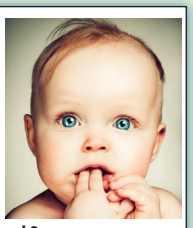
PETER

AGE: 22 years old
HEIGHT: 5'11"
WEIGHT: 158 lbs.
LIVES IN: Boulder, CO

PERSONAL INFORMATION:

- Senior at the University of Colorado, Boulder
- After graduation, plans on becoming a counselor for at-risk teens
- Only child
- His heart disease is advancing rapidly
- Has been placed on the Transplant Waiting List for immediate heart transplant

ISABELLA



AGE: 6 months old
HEIGHT: 20"
WEIGHT: 5 lbs. 3 oz.
LIVES IN: Colorado Springs, CO

PERSONAL INFORMATION:

- Has 2 healthy siblings, ages 5 and 3
- Father, Ed, is stationed at Fort Carson Army Base
- Mother, Candy, works part-time in a dentist office
- She was born with a heart defect which requires transplant
- Has been on the Transplant Waiting List since birth

SUSAN

AGE: 13 years old
HEIGHT: 5'2"
WEIGHT: 101 lbs.
LIVES IN: Arvada, CO

PERSONAL INFORMATION:

- Has one healthy sibling, age 9
- Parents have been happily married for 27 years
- Currently a 7th grader at Arvada Central Junior High School
- A bacterial infection caused her to be placed on the Transplant Waiting List for immediate heart transplant

STATION 2 ACTIVITIES

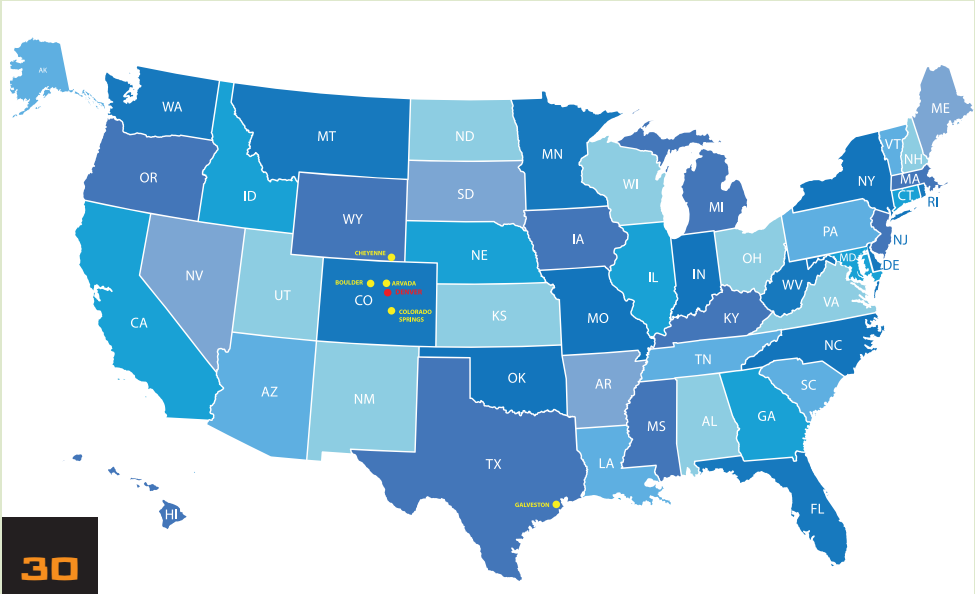
Critical Thinking/ Discussion Questions

1. **Given what you have learned about organ matching, why is it important for a computer algorithm to determine the best match rather than a person?**
2. **Why has the Federal government designated an organization (UNOS) to set policies on how organs will be allocated?**
3. **Should additional factors such as an individual's contribution to society, whether the person in need has children, or economic status be considered when determining who gets an organ transplant? Why or why not?**
4. **What would happen if people were allowed to buy and sell organs for transplant?**
5. **Why is it difficult to recover a heart after DCD?** *Hint: the answer is on page 20*

Donor Service Areas in the United States

Distance between the donor and recipient matters when allocating an organ. Please take the following into consideration when considering geographic location:

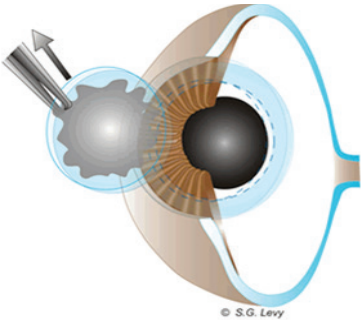
- **Denver to Galveston, TX = 16 hours driving, or 2 hours flight + 1 hour drive**
- **Cheyenne, WY to Denver = almost 2 hours driving**
- **Colorado Springs to Denver = 1.5 hours driving**
- **Boulder to Denver = 30-45 minutes driving**



STATION 3

THE EYE

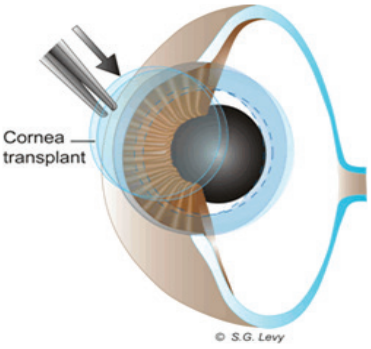
Corneal Transplants

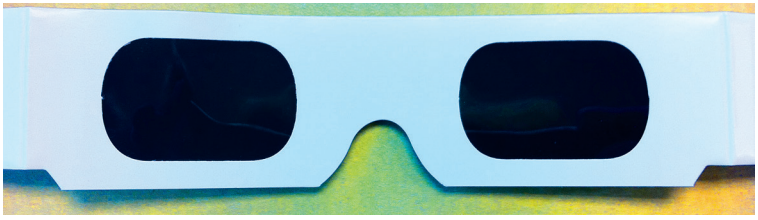


Any number of events, from a corneal disease to irreparable damage from trauma, could generate the need for a corneal transplant. During a transplant, the surgeon delicately removes the damaged or diseased cornea from the patient's eye using surgical instruments.

The surgeon replaces the old cornea with the donated cornea, which is prepared to fit perfectly into the patient's eye.

The surgeon uses very fine stitches to secure the new cornea into the patient's eye, and the stitches are left there until the cornea has bonded completely to the eye. The surgeon can also periodically adjust the stitches to help shape the cornea to allow the patient to see better through it. These stitches are 28 microns (µm) thick! (See the handout on microns to see just how small that is.)





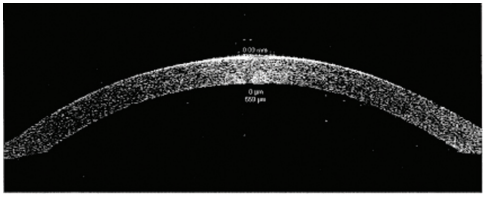
Please locate the glasses on the table at Station 3. Rocky Mountain Lion's Eye Bank has provided these glasses which simulate corneal blindness. Put them on and look at the eye chart and decide if *you* would want a transplant if this was *your* vision quality.

WHAT'S A MICRON?

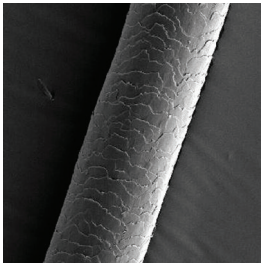
One micron is one-millionth of a meter! That's 1/1,000th of a millimeter. A micron is symbolized by the notation: **µm**. The stitches used in cornea transplant surgery are 28µm thick and the needle is 70µm thick.

To get an idea of how big a micron is, consider these things:

A dime is about 1 millimeter thick, or 1,000 µm.

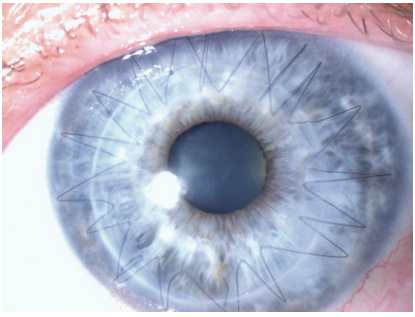


This is a cross-section scan of a human cornea. It is 559 µm thick or about half the thickness of a dime.



This is an electron microscope scan of a human hair. The average human hair is about 180 µm thick. If you stacked up six human hairs, they would be about equal to the thickness of a dime.

Please reference the card on the table at the Station 3 to view and touch the stitches used in a corneal transplant.



Corneal Slit Lamp Evaluation

After donated corneas are recovered and brought to the eye bank, they are first evaluated under the slit lamp. With this instrument, eye bank technicians look at all five layers of the cornea. If there are no signs of physical damage to any cell layers, the cornea will go on to the next phase in the evaluation process.

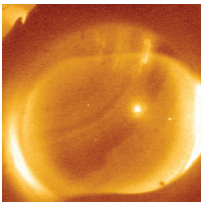


Figure 1

Figure 1 is an example of what a healthy cornea looks like under the slit lamp. The outer layer, or epithelium, appears intact and translucent. There are no signs of physical damage or deterioration of the epithelium or the other four layers.

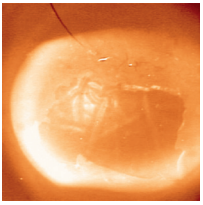
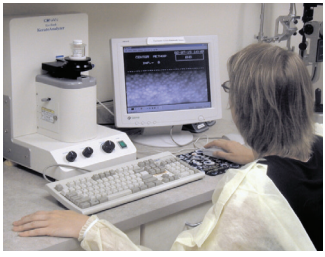


Figure 2

Figure 2 is a cornea that shows significant dryness and deterioration of the epithelium. This cornea is more opaque and doesn't allow much light through. Unfortunately, it does not appear to be healthy enough for a transplant.

Corneal Specular Microscopy



If a donated cornea passes the slit lamp evaluation, it gets evaluated under the specular microscope. This instrument looks at the cells on the inner-most layer, the endothelium. These cells pump water out of the cornea and keep it clear. The endothelium must contain at least 2,000 cells per square millimeter for the cornea to be transplantable.

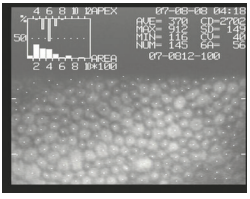


Figure 3

Figure 3 is a specular microscopy photo of a cornea with an endothelial cell density of 2,702 per square millimeter, higher than the minimum requirement. The individual cells are honeycomb-shaped, have similar sizes, and are plentiful. This cornea would be suitable for a transplant.

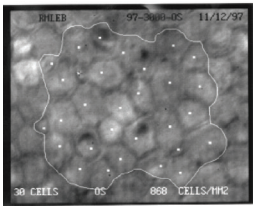


Figure 4

Figure 4 is a specular microscopy photo of a cornea with an endothelial cell density of 868 per square millimeter. The cells are not of similar shape and size, and they're also larger, so there are fewer of them. For these reasons, this cornea would not be suitable for a transplant.

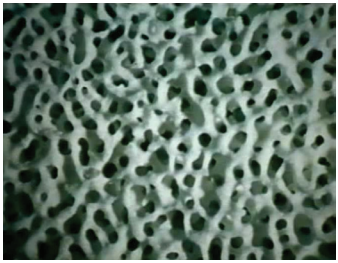
To see larger images, review the Specular Microscopy poster at station 3.

Hydroxyapatite Orbital Implants

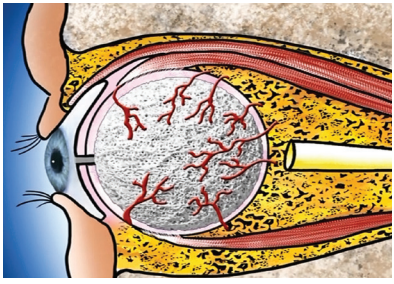
Sometimes, people may lose an eye because of a traumatic injury. At other times, a diseased eye may have to be surgically removed. This is called enucleation. For many years, the enucleated eye was replaced with a glass eye. While these artificial implants look real, they don't move. A new procedure uses donated sclera, or the white part of the eye. This new procedure can be performed about 2-3 weeks after the removal of the damaged or diseased eye.

This man had the traditional glass eye to replace his enucleated eye. Can you tell which eye is the artificial one?

This newer procedure makes it possible for an artificial implant to move naturally so no one can tell it is an artificial.



Hydroxyapatite is mineral produced from the mineral found in coral skeletons. The material can then be shaped into a ball the size of the human eye. The donated sclera is wrapped around the hydroxyapatite ball and the eye muscles reattached to the sclera so that the artificial eye moves naturally. A cap that is hand-painted to match the person's other eye is placed on a post completing the procedure.



Because hydroxyapatite is porous, blood vessels can grow through it to nourish the donated sclera. The implant becomes a permanent part of the body.

SCLERA

Both of these people have one eye replaced with a hydroxyapatite orbital implant using donated sclera. Because both eyes move together in a very natural way, it is almost impossible to tell which eye has the implant.

Good eyesight is not a requirement to be an eye donor. Even people who have been blind from birth can restore eyesight in some cases.

In 2018
2,643 EYE DONORS
gave the gift of sight with

2,428
CORNEAS TRANSPLANTED

ADDITIONALLY, **75** SCLERA WERE TRANSPLANTED

STATION 3 ACTIVITIES

Match The Cornea To A Recipient

DIRECTIONS

Match each of the available donated corneas on the left with a transplant recipient on the right. Write your answers in your workbook along with why you chose that particular cornea for the patient. *Note: one person will not get a transplant in this round.*

Use these guidelines in making your decision:

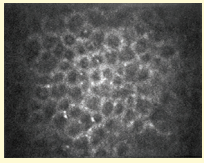
1. **The younger the patient, the higher the cell count they will need. The cells must last a lifetime!**

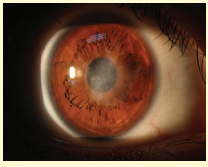
2. **The graft size in the donor cornea must be greater than or equal to the cornea size of the recipient or it won't fit.**

A. Donor Age: 19 years
Cell count: 3,198 cells/mm2
Graft size: 7.7mm

B. Donor Age: 55 years
Cell count: 2,250 cells/mm2
Graft size: 8.0mm

C. Donor Age: 40 years
Cell count: 2,400 cells/mm2
Graft size: 7.0mm





1. Sally
AGE: 3 months
Diagnosis: Peter's Anomaly
Cornea size: 6.5 mm

2. Tim
AGE: 17 years
Diagnosis: Keratoconus
Cornea size: 8.5 mm

3. Sue
AGE: 30 years
Diagnosis: Fuch's Dystrophy
Cornea size: 7 mm

4. John
AGE: 40 years
Diagnosis: Scar from old eye injury
Cornea size: 7 mm

STATION 3 ACTIVITIES

GOAL: Match available corneas to transplant recipients.

DIRECTIONS
Using the criteria on page 36, decide which available corneas will go to which recipient. One recipient will NOT get a transplant at this time.

Patient	Which Cornea?	Why did you assign this cornea to this patient?
1. Sally **AGE: 3 months** **Diagnosis: Peter's Anomaly** **Cornea size: 6.5 mm** **Location: Colorado**		
2. Tim **AGE: 17 years** **Diagnosis: Keratoconus** **Cornea Size 8.5 mm** **Location: Colorado**		
3. Sue **AGE: 30 years** **Diagnosis: Fuch's dystrophy** **Cornea Size: 7 mm** **Location: Seattle**		
4. John **AGE: 40 years** **Diagnosis: scar from old eye injury** **Cornea size: 7 mm** **Location: Illinois**		

Which recipient does not get a transplant in this round? _____

Why? _____

_____

_____

Recover or Procure	**Harvest**
Donated Organs & Tissues	**Body Parts**
Deceased Donor or Deceased Donation	**Cadaver or Cadaveric Donation**
Ventilator Support or Mechanical Support	**Life Support**
Decision	**Wish**

It's important to remember to use sensitive language when speaking about deceased donors. You never know if someone you are talking to has a loved one who is a donor. How would you want someone to speak about your friends and family?

STATION 4

TISSUES, BONE & SKIN

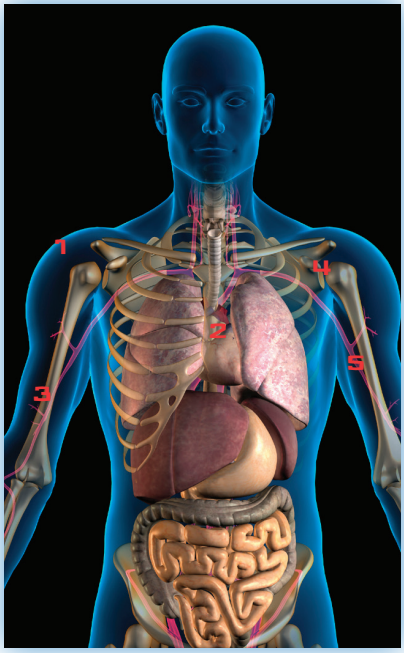
1. Skin
Protects the body from dehydration, injury and infection. Transplant often used as treatment for burn patients. Decreases pain, infection, scarring, heat and fluid loss.

2. Heart Valves
Direct flow of blood through heart. Transplant replaces diseased heart valves.

3. Bone
Supports the body, protects vital organs. Transplant used in facial reconstruction, prevention of amputation, correction of birth defects, cancer treatment, spinal fusion and oral surgery.

4. Cartilage / Tendons / Femoral Nerve
Connective tissue. Transplant used in facial and other reconstructive surgery such as ACL repairs.

5. Veins
Transport blood. Transplant used for coronary by-pass surgery to replace diseased or blocked arteries.



FACTOIDS

One tissue donor can help save and heal the lives of more than 75 people.

Tissue can be recovered up to 24 hours after death.

The earliest records of skin grafts date back to 3000-2500 B.C.E.

Approximately 50 grafts can be made from the leg of one tissue donor.

Some bone grafts can signal the patient's body to grow more bone. These bone grafts are called osteoinductive. Patients often heal faster and do better with this type of transplant.

There is always a need for more tissue to save and heal patients.

THE DONATION PROCESS

Tissue donors have the potential to save and heal dozens of people through their donated gifts. The Tissue Donation Process is somewhat different from the Organ Donation Process. Tissues can be recovered up to 24 hours after death. While donated organs have to be transplanted within a few hours of recovery, tissues can be preserved and transplanted for up to five years. Here's how it works:

DIAGNOSIS, REFERRAL AND FAMILY DISCUSSION

These first steps are the same for Tissue Donors as with Organ Donors. Please see p. 19-21 for these steps. A difference in this process is that the Tissue Donor Coordinator (TDC) contacts the family by phone rather than in person at the hospital.

MEDICAL/SOCIAL ASSESSMENT After the family has been notified that their loved one is a registered donor or they have authorized donation, the deceased patient is assessed for suitability for tissue donation, based on criteria such as age, cause of death and medical history. The family must also answer a medical/social questionnaire (similar to those asked when a person donates blood). These questions are asked for the protection of the recipients and to screen for communicable diseases, such as HIV and hepatitis. The medical history is also examined to ensure the tissue is suitable for transplantation.

SURGICAL RECOVERY If the donor's tissues are eligible to be donated, a surgical team of Tissue Recovery Coordinators (TRCs) recovers them in an aseptic surgical procedure. Great care is taken in the recovery of tissues to ensure presentation of the donor for funeral purposes.

MEDICAL EVALUATION After the tissues are recovered, additional medical records are requested from the hospital, primary care physicians, and coroners. These records are reviewed to make sure that nothing was missed during the Medical/ Social Assessment or the physical evaluation that could harm a recipient. Once the medical records are reviewed and the recovery documentation is approved according to regulatory standards, the information is sent to the tissue processors for additional review and approval for transplant by a medical director.

PRESERVATION Recovered tissues are packaged and sent to tissue processors where they are used to create numerous grafts for transplant in procedures such as ACL replacement, coronary artery bypass surgery, skin grafts and more. If the tissues are not suitable for transplant, they may be used for research and training.

TRANSPLANT When a patient needs a tissue graft, their doctor will request it from a tissue processor, schedule the surgery and transplant the tissue into their patient.

aseptic: germ-free

WHAT IS AN ALLOGRAFT?

Tissues transplanted from one part of the body to another in the same individual are called autografts. Tissues transplanted from one person to another are called allografts. Allograft tissue comes from a deceased donor.

One tissue donor can save and heal the lives of more than 75 people. Currently, there are nearly 36 million Americans with debilitating musculoskeletal conditions who might benefit from an allograft. Approximately 1.5 million allografts are transplanted each year for a variety of lifesaving and healing surgeries:

- bone grafts for patients whose bones have degenerated from cancer
- cornea transplants to help restore sight
- heart valves to replace damaged heart tissue
- skin grafts to save the lives of burn victims
- tendon, meniscus and soft tissue replacements to help people lead more active lives

While tissue transplantation is a fairly common procedure used to treat trauma, sports and age-related injuries, the number of procedures is limited by the availability of donor tissue. Generous donors who make the choice to donate the gift of tissue provide renewed possibilities for the tens of thousands of patients who receive an allograft transplant each year.

THE BENEFITS OF ALLOGRAFT

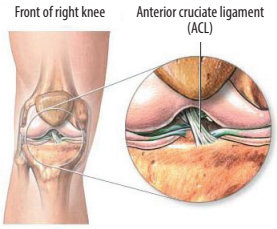
The benefits of allograft tissue transplantation are numerous compared to synthetics or autograft tissue.

- Allograft transplants eliminate the pain and potential infection associated with the second surgical site necessary for autograft procedures.
- It is common for an allograft procedure to reduce patient discomfort and shorten hospital stays, as compared to autograft procedures.
- Large bone grafts, such as a femur for the leg or humerus for the arm, would not be possible without allografts, since such grafts cannot be obtained from the patient's own body.
- Some bone grafts are osteoinductive, meaning they "signal" the patient's body to begin making new bone, promoting faster healing and better surgical outcomes.
- Using allografts often reduces the cost of medical care.
- Many of the country's top surgeons continue to perfect allograft transplantation techniques and expand the possibilities for allograft surgery.

Here are several examples of how one donor can help save and heal the lives of many:

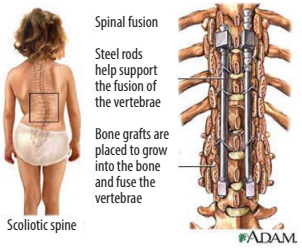
Anterior cruciate ligament (ACL) surgery (Non bone Tendon)

Anterior cruciate ligament (ACL) reconstruction is surgery to repair a tear in an ACL, one of the major ligaments in the knee. Tearing of the ACL is the most common knee ligament injury. Sports and fitness routines that involve running, pivoting, turning and jumping lead to many torn ACLs. The ACL is one of the main stabilizing ligaments of the knee. It prevents the lower leg bone (tibia) from going too far forward. Once torn, the ACL won't heal, so fusing the torn ends is not an option. With ACL reconstruction, the torn ligament's function is not restored. ACL reconstruction involves creating a new ACL from grafted tissue, usually a non-bone tendon graft or a bone-tendon-bone graft.



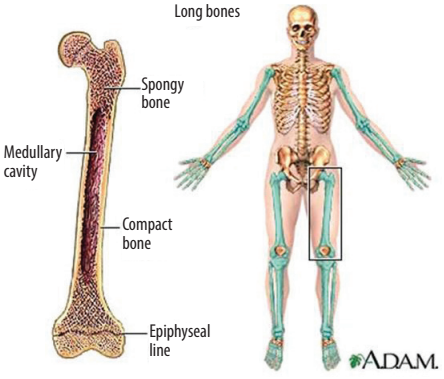
Spinal Fusion Surgery (Machined Graft)

Spinal fusion is surgery to permanently connect two or more vertebrae in the spine, eliminating motion between them. Spinal fusion involves placing extra bone (bone graft) to fill the space between two spinal vertebrae. The bone graft material used in spinal fusion may be in a preformed shape, or it may be contained within a plastic, carbon fiber or metal cage. Plates, screws or rods may be used to hold the vertebrae and graft in place to promote healing after spinal fusion. Once the bone graft heals, the vertebrae are permanently connected.



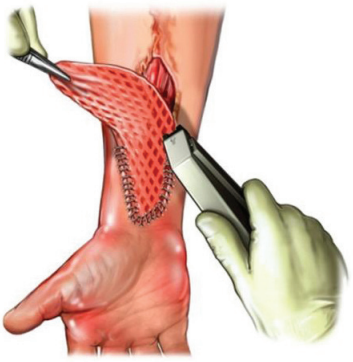
Bone Resection

Benign bone tumors may require open or radical surgery (resection). Benign tumors are resected using a bone-scraping procedure called curettage. This is usually able to remove the entire tumor and reduce the possibility of recurrence. Curettage is followed by reconstruction using a combination of bone grafts and stabilization to prevent fracture. The resection of some benign bone tumors may leave large deficits in the involved bone that may be filled with bone grafted from the individual's own bone (autograft), with donor bone (allograft), or with synthetic bone substitutes (e.g., coralline hydroxyapatite). Generally, when an allograft is used, a deceased donor bone that is similar in size and shape is requested.



Skin for Burns

Skin grafting is most often used in the treatment of burns. For first or second-degree burns, skin grafting is generally not required, as these burns usually heal with little or no scarring. People who suffer third-degree burns often require skin grafting because the skin has been damaged to its full depth, including underlying tissues. In order to prevent infection or loss of fluid, these types of injuries must be covered as quickly as possible. If left to heal on their own, they may contract infection which could result in serious scarring. If the injury is large enough, the scar could actually prevent movement of limbs.



› ***Recovery Technique:*** Skin for grafts of this nature is recovered using a dermatome, an instrument used for the process of recovering skin for transplant. When skin is recovered, it is approximately the thickness of a sheet of paper.

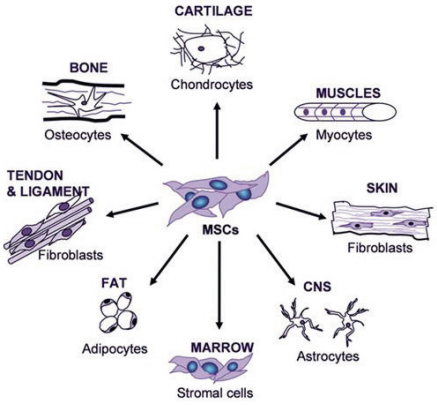
Full Thickness/Wide Area Graft

More serious, non-healing wounds, such as diabetic ulcers, venous ulcers or pressure sores, can be treated with a different type of skin graft to prevent infection or further progression of the wounded area.

› ***Recovery Technique:*** A full thickness skin graft involves identifying a suitable area of skin tissue (generally the back and thigh and/or calf) and inscribing the recovery area with a full thickness surgical incision, followed by recovering the skin for transplant. The result is a graft that can be several times larger than one recovered with dermatome.

Stem Cell Bone

Adult stem cells, the only type of stem cells recovered, can be recovered from ground bone, muscle, or adipose (fat). Stem cells are cells that are capable of becoming different types of cells and tissue. People continue to have stem cells in almost every tissue in their body throughout their lives. There are many uses for adult stem cells that continue to be explored.



An open casket funeral is possible for organ, eye, and tissue donors.

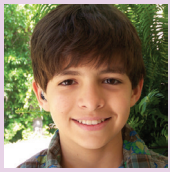
STATION 4 ACTIVITIES

I. GOAL: Determine who will receive each transplantable tissue based on their injury.

DIRECTIONS

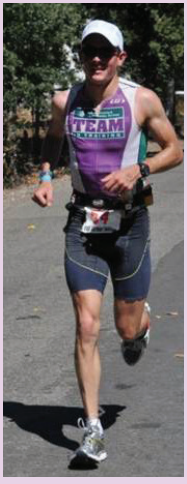
1. **MATCH the type of allograft with the person who needs it.**
2. **WRITE the letter of the best choice in the line provided.**

A. Skin B. Machined Graft C. Whole Bone D. Non-Bone Tendon E. Cartilage



_____ Devin was a typical 12-year-old who loved to play soccer and spend time with his friends. On a Sunday morning at church, Devin was pouring a cup of cocoa when the cup slipped and he spilled the cocoa on his arm. The hot cocoa immediately took the skin off from the bottom of his thumb, to the middle of his forearm. Devin was rushed to the emergency room where he was diagnosed with third degree burns. What allograft did the doctors use for Devin?

_____ Meg lives a very active life as a professional cycling coach, runner and yoga teacher. She suffered from knee pain for several years, but didn't need surgery until a mountain biking accident. When she visited her surgeon, she learned that she had a large defect in her knee tissue. What allograft did her surgeon use to help heal her knee?



_____ Over the summer H.C. returned to his former university, Colorado College in Colorado Springs, for an alumni soccer game. He played on the team in college and has since remained very athletic, participating in triathlons and skiing. However, at the time of the game, it had been a while since he'd played soccer. Following a cutting motion on the field, he felt his leg let go below the knee. H.C. instantly knew his ACL and lateral meniscus were torn. What allograft did the doctors use to heal H.C.?

_____ As a varsity tennis player at Kansas State, Andy was on top of his game; starting college, playing a sport and living on his own. All of that was threatened when he was diagnosed with bone cancer in his leg. What allograft will help Andy become cancer free?

_____ Debby, a 50-year-old, suffers from a degenerative arthritic condition in her spine that resulted in constant neck pain. While she saw a chiropractor weekly and the therapy would provide momentary relief, nothing fully eradicated the problem. Two of Debby's discs were protruding and pushing on her spinal cord. Debbie needed surgery. What allograft did the surgeons use on Debby?

II. GOAL: Discover and identify each of the transplantable tissues.

DIRECTIONS

1. **MATCH the name of the tissue with its function.**
2. **WRITE the letter of the best choice in the line provided.**

A. Skin B. Valves C. Bones D. Cartilage / Tendons / Femoral Nerve E. Veins

_____ This is used as connective tissue in reconstructive surgery.

_____ This protects the body from dehydration, injury and infection and is often used for burn victims.

_____ These direct the flow of blood through the heart.

_____ These support the body and protect vital organs.

_____ These transport blood.

8 FACTS ABOUT ORGAN, EYE & TISSUE DONATION

1

Anyone can register to be an organ, eye and tissue donor, regardless of age, race, or medical history.

2

An individual's donation status does not affect medical care. The first priority of medical professionals is to save lives.

3

Organ, eye and tissue donation does not become an option until death has been declared.

4

All major religions in the United States support donation and view it as a final act of love and generosity.

5

There is no cost to the donor or their family for organ, eye or tissue donation.

6

An open casket funeral is possible for organ, eye, and tissue donors.

7

The donor and family are treated with the utmost care, respect, and dignity throughout the donation process.

8

A "living donor" can also save lives by donating a kidney or a part of the liver, intestine, lung, or pancreas.

FAMILY DISCUSSION

Results of this activity are used to improve the program; participants will remain anonymous and will not be contacted.

DIRECTIONS

1. Take this workbook home and discuss the information below with a parent or guardian.

2. Write your answers in the spaces provided.

3. Return p. 47-48 to your teacher. (The rest of the workbook is yours to keep!)

STUDENT NAME: _____

SCHOOL: _____

TEACHER: _____

DATE: _____

PARENT/GUARDIAN* SIGNATURE: _____

*OPTIONAL

1. Does anyone in your family know someone who is currently waiting for or has received a lifesaving organ transplant?

❑ Yes, we know someone waiting. Which organs? _____

❑ Yes, we know someone who has received. Which organs? _____

❑ No

2. Does anyone in your family know someone who became an organ and/or tissue donor after their death?

❑ Yes If yes, do you know which organ(s) and/or tissue(s) they donated?

_____

❑ No

3. If you or someone in your family were ill or injured, would you/they consider receiving an organ or tissue transplant? Why or why not?

❑ Yes _____

❑ No _____

4. Is anyone in your family already signed up to be an organ and tissue donor?
(Hint: check for a heart on their driver license or ID.)

❑ Yes Who? _____

❑ No If not, would they consider it? _____

5. Do you believe the following statements to be true or false?

TRUE	FALSE	
❑	❑	Anyone can sign up and potentially save lives through organ, eye and tissue donation after death.
❑	❑	The decision to be an organ, eye and tissue donor will not interfere with an individual's medical care. The medical team caring for someone before death is not involved in the donation process after death.
❑	❑	Past or existing health conditions such as cancer, diabetes or hepatitis do not rule you out from being a donor after death.
❑	❑	Organ, eye and tissue donation does not cost the donor's family anything.
❑	❑	The donor and their family are treated with great care and respect throughout the donation process.

6. Check the box with the correct answer.

What is donation?	❑ donation is receiving ❑ donation is giving		
A person can recover from brain death.	❑ Yes ❑ No		
You can donate if you are deceased and if…	❑ you are younger than 30 years old ❑ you are older than 30 but younger than 60 ❑ you are older than 60 ❑ age doesn't matter		
Check off the tissues that can be donated.	❑ bone tissue ❑ intestine (bowel)	❑ skin ❑ pancreas	❑ heart valve ❑ cornea
If an organ or tissue is damaged, it could have a negative effect on other body systems.	❑ Yes ❑ No		
Which two organs may be affected most by smoking?	❑ heart ❑ small intestines	❑ liver ❑ kidneys	❑ pancreas ❑ lungs

7. What was the most interesting thing you learned today?

- ❑ Information about the organs at Station 1
- ❑ How to allocate an organ at Station 2
- ❑ What corneal blindness feels like at Station 3
- ❑ How skin and tissue can be made into different grafts at Station 4
- ❑ Other _____

_____

8. Is there anything else you would have liked to learn through the Transplantation Science program? _____

_____

Transplantation
SCIENCE

made possible through donations to
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Tissue Donation Awareness Fund
at the Driver License Office

thank you to the following organizations
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AlloSource™
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Rocky Mountain Lions Eye Bank
Share the circle of light

THIS WORKBOOK BELONGS TO:

_____

If you would like more information about organ, eye and tissue donation or have any questions regarding the Transplantation Science program, please email TransplantationScience@donoralliance.org or call 303.329.4747.

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