

ORGAN BANKS

Organ and tissue banks recover, process, store, and distribute human organs, bone, and tissue for transplantation. Donations are made from people who agree to donate upon their death. A single organ and tissue donor can save or improve the lives of 40–50 people: by donating up to seven vital organs, two eyes for corneal transplants, and bone and soft tissue to benefit 30–40 others. Some organ and tissue banks may also have tissue available for educational and research purposes. However, the demand for organs, bone, and tissue usually exceeds the supply. Therefore, only organs and tissues not suitable for transplantation are available for research. A few organ and tissue banks are described below, and Appendix H contains a partial list of organ and tissue banks in the United States.

Eye banks have been one of the fastest growing types of tissue banks in the latter half of this century. The first eye bank opened in 1946 in New York City and was operated by Dr. R. Townly Paton, who is known as the father of modern eye banking. Currently, almost 100 banks operate in the United States. The advancing technologies in corneal transplant have stimulated the growth of eye banks, and, as with other organs, the demand for transplant tissue is greater than the supply. In 1997, more than 85,000 eye donations (corneas or whole globes) were reported from U.S. Eye Banks (Eye Bank Association, 1998). In 1997, more than 43,000 eye donations were used for corneal transplants and more than 21,000 were used in research (Eye Bank Association, 1998). More than 550,000 cornea transplants have been performed since 1961 with a 90 percent success rate in restoring sight (Eye Bank Association, 1998).

Many of the nonprofit eye banks are funded by local Lions Clubs. Several eye banks are briefly described below that donate tissue for research purposes as well as transplantation procedures. For a more complete list, refer to Appendix H for a state-by-state listing of organ banks.

Northwest Tissue Center

A division of the Puget Sound Blood Center, the Northwest Tissue Center provides musculoskeletal and cardiovascular tissue for transplantation in Washington, Alaska, Montana, and Idaho. Established in 1988, the center is the region's only full-service, nonprofit tissue bank. Each year tissue is provided for more than 4,000 allografts. The donor's medical history and circumstances surrounding the donor's death are gathered from the health-care provider. The donors are screened for infectious, neurological, and autoimmune diseases as well as cancer and drug abuse. Additional information is provided by family members. Laboratory testing for HIV, HTLV-I and-II, hepatitis B and C, and syphilis ensures the safety of the donated tissue. The process is confidential, and the recipients do not know from whom the tissue was received.

New England Organ Bank

The New England Organ Bank (NEOB), a collaborative enterprise of six Boston hospitals started in 1968, is the oldest independent organ bank in the United States. Currently it is a federally designated organ procurement organization for all parts of the six New England states, including thirteen transplant centers with the capability to perform all types of organ and tissue transplantation. Through the United Network for Organ Sharing (UNOS), the NEOB provides organs for transplant outside of New England when a compatible recipient cannot be found in New England. NEOB Tissue Services began recovering bone and other musculoskeletal tissues for orthopedic surgeons in 1988. All tissues procured are collected, processed, tested for infectious diseases, stored, and distributed according to the Standards for Tissue Banking of the American Association of Tissue Banks.

Rochester Eye and Human Parts Bank, Inc.

The Rochester Eye and Human Parts Bank, Inc., was originally founded as the Rochester Eye Bank and Research Society in 1952 by the Downtown Lions Club. In 1968, the eye bank expanded to include the collection of all organs and tissues and adopted its current name. The bank currently procures, processes, preserves, and distributes eyes, skin, and cardiovascular and musculoskeletal tissues for transplant, research, and medical education.

Old Dominion Eye Bank

The first eye bank in Virginia was established in 1956 through the Medical College of Virginia. In 1962, the eye bank was reorganized and came under the

direction of the Old Dominion Eye Foundation, Inc., a nonprofit organization, and the Old Dominion Eye Bank (ODEB). ODEB is supported by multiple Lions Clubs. ODEB serves as a receiving, processing, research, and distribution center for donated eye tissue. ODEB coordinates events from the time of the donor's death to the transplantation of the eye tissue. ODEB provides human eye tissue for corneal transplants, ophthalmic research, and educational training.

Utah Lions Eye Bank

The mission of the Utah Lions Eye Bank is to procure, test, evaluate, and distribute quality eye tissue for transplantation and research. The eye bank accepts donor tissue from donors of any race, religion, or age. Tissue specimens are supplied to researchers investigating macular degeneration and retinal cell transplantation at the John A. Moran Eye Center. Tissue may also be requested by physicians and other professionals for teaching, research, and development of new surgical techniques at the University School of Medicine.

Iowa Lions Eye Bank

The Iowa Lions Eye Bank in the Department of Ophthalmology and visual science at the University of Iowa was established in 1955. The eye bank is a nonprofit service committed to the restoration and preservation of sight through the collection, processing, and distribution of human ocular tissue for transplantation and research. Research areas include eye pathology, ocular melanoma, macular degeneration, and molecular ophthalmology. Tissue is first made available to Iowa surgeons for transplant. If it cannot be used in Iowa, it is then offered to other states and abroad. If the tissue is unsuitable for transplant, it is distributed to various research programs in the Department of Ophthalmology at the University of Iowa and to surgeons throughout the state. In 1995, the eye bank received 30 percent more eye donations than the previous year, 15 percent more in 1996, and 7 percent more in 1997. In 1995, the number of eyes distributed for transplant almost equaled the number distributed for research and training. In 1997, though, the number of donated eyes used for research was almost double the number used for transplants.

Kentucky Lions Eye Bank

The Kentucky Lions Eye Bank was founded in 1954. Its objective is to procure and distribute human donor eye tissue for transplant and ophthalmic research. In 1996, the eye bank had 204 eye donations. Tissue from eye donors aged 5–75 is suitable for transplantation if no problems are detected during the physical

assessment or medical chart review of the donor. Tissue specimens that are distributed for research include whole eye, conjunctiva, lens iris/ciliary bodies, posterior poles (whole eye with the cornea removed), and cornea retina.

Central Florida Lions Eye and Tissue Bank, Inc.

The Central Florida Lions Eye and Tissue Bank, Inc. (CFLETB), was founded by a group of Tampa Lions in 1973. The eye and tissue bank is committed to the recovery, evaluation, and distribution of eye tissue for transplantation, research, and education. CFLETB has donated eye tissue to more than 20,000 individuals worldwide.

Mid-America Transplant Services

The Mid-America Transplant Services (MTS) is a fully accredited private, not-for-profit corporation designated by Medicare to coordinate the procurement of vital organs, eyes, bone, and soft tissue in hospitals throughout Missouri, southern Illinois, and northeastern Arkansas. Vital organs donated include heart, kidney, lung, liver, intestine, and pancreas. Tissues donated include eyes, long bones from the legs, heart valves, and tendons.

In 1995, MTS procured 318 vital organs from 97 local donors and imported another 147 vital organs. MTS also had 234 bone/soft tissue donors and 1,215 eye donors. All potential organ and tissue donors are carefully tested for cancer, infectious diseases, and AIDS before donation can proceed. Organ and tissue donation can proceed only after death has been declared and the next of kin has given consent. There is absolutely no cost to the donor family for organ or tissue donation.

The MTS Eye Banking Services recovers human eye tissue from recently deceased donors and then processes and preserves the tissue for distribution to ophthalmologists for corneal transplantation surgery. Donor eyes not suitable for transplantation may be given to researchers studying the causes and possible cures of blindness and to ophthalmology residency programs for education purposes, and for practicing ophthalmic surgery procedures. MTS also acts as a coordinating center for sharing of tissue among eye banks through its Tissue Sharing Services.

The eye tissue that MTS provides for research purposes includes whole eyes, posterior poles, lens, conjunctiva, retina, and choroid. Tissues can be preserved to meet the needs of individual researchers. Eyes from individuals with known eye diseases are especially valuable for study. In addition, MTS is involved in research to explore the possibility of retinal cell transplantation as a therapy for

such diseases as retinitis pigmentosa and age-related macular degeneration. Donor tissue used for research on eye disease is extremely valuable to medical progress in treating blindness.

American Red Cross Tissue Services

The American Red Cross Tissue Services, established in 1984, collects, processes, and distributes human allograft tissue for use in transplantation. The Red Cross is one of the largest tissue collection-and-distribution organizations in the United States, supplying approximately one-quarter of the nation's tissues for transplantation. There are 17 tissue centers throughout the country and a national office in Washington, D.C. The American Red Cross Tissue Services distributes more than 70,000 units of tissue procured from more than 2,000 donors per year. For example, the Greater Northeast Area Tissue Services, the smallest of six Red Cross Tissue Centers, stores thousands of bone, skin, connective tissue, and heart valve samples from cadavers for transplantation, some research, and some education.

Tissue is obtained from deceased or surgical donors. Donors range in age from newborn to over 80. Tissue donors can sign a donor card but must make their wishes known to their families because the family's consent is required before tissues can be donated after death. All tissues are tested for diseases, such as AIDS, hepatitis, and syphilis.

The Red Cross distributes heart valves, skin, ligaments, tendons, bone, major blood vessels, and fascia, which covers muscles. These tissues are used in orthopedic, neurologic, ophthalmologic, plastic, cardiovascular, and oral reconstructive surgery for a wide range of medical procedures, such as salvaging limbs after tumor surgery, reconstructing hip and knee joints, replacing corneas, and correcting curvature of the spine. Tissue transplantation does not require the donor and the recipient to have the same blood type.

The Tissue Services Research program was established to provide research and development support to optimize human bone processing methods and to ensure the safety of American Red Cross allograft bone. It is a multidisciplinary effort with several departments, including Biochemistry, Coagulation Proteins, Experimental Pathology, Immunology, Molecular Biology, Plasma Derivatives, Platelet Biology, Product Development, Transmissible Diseases, and Virology. The Tissue Services Research program conducts *in vivo* and *in vitro* studies with human demineralized bone matrix to determine the bioactivity of various lots of bone. They are also developing a new bone delivery system for handling demineralized bone matrix during patient surgery. The Tissue Services Research program is also studying growth factors and viral inactivation.

Missouri Lions Eye Research Foundation

The Eye Research Foundation is located in Columbia, Missouri, and operates several different programs, including Eye Research, Operation of the Missouri Lions Eye Tissue Banks in three Missouri cities, Glaucoma Screening, Eyeglass Recycling, Amblyopia Screening, Indigent Patient Care, and Public Education. The foundation conducts research into eye diseases and disorders and ways to provide tissue of a higher quality for transplant purposes. In response to specific requests, the Foundation provides eye tissue for three corneal projects (University of Missouri, Kansas State University, and NIH), two glaucoma projects (St. Louis University, University of Nebraska), and two retinal cell transplant projects (Washington University, NIH).

BLOOD BANKS

During World War I, it was demonstrated that blood could be safely stored. Prior to World War I, a physician would screen a patient's friends and relatives until the proper type was found and then would bleed the donor and immediately transfuse the patient. Several discoveries in the early twentieth century, however, allowed for creation of blood banks today. In 1914, Luis Agote demonstrated that small, nontoxic quantities of sodium citrate could prevent coagulation of the blood, which led to the development of blood storage. In 1943, John Freeman Loutit and Patrick Loudon Mollison acidified the citrate and added dextrose, which allowed for the storage of red cells at 4°C for a period of 21 days. Further addition of adenine increased the storage time of blood in the liquid form. The first blood bank in the United States opened in 1937.

Whole blood can only be stored for a limited time, but various components of blood (red blood cells, platelets, albumin, and plasma fractions) can be frozen and stored for a year or longer. The cryoprotective agent glycerol protects red blood cells from destruction in freezing temperatures. Most blood donations, therefore, are separated and stored as components by blood banks. A single unit of blood can potentially serve the varying needs of five or more patients.

Blood banks exist in every state in the United States. As is common with organ banks, there are often shortages of specific types of blood, and blood drives are held to maintain existing stocks of all blood types. The American Association of Blood Banks (AABB) is an international organization of blood banks, transfusion and transplantation services, and those working in these groups—more than 2,200 institutions (community and hospital blood banks, hospital transfusion services, and laboratories) and 8,500 individuals are AABB members. The AABB also has an accreditation program that strives to improve the quality and

safety of collecting, processing, testing, distributing, and administering blood and blood products.

America's Blood Centers (ABC), founded in 1962, is a national network of non-profit community blood centers. ABC members collect almost half (47 percent) of the U.S. blood supply at 450 donation sites in 46 states. ABC members are licensed and regulated by the U.S. Food and Drug Administration. Some of the nation's blood centers are briefly described below. For a more complete listing of U.S. blood centers, see Appendix H.

American Red Cross

The American Red Cross collected approximately 5.8 million blood donations in 1996. However, the Red Cross represents about half of all U.S. blood donations, so annually, about 12 million units of blood are donated in the United States. The American Red Cross usually maintains about a three-day supply of fresh blood as well as approximately 20,000 units of frozen blood at any one time. The American Red Cross also maintains the world's largest registry of frozen rare blood. Approximately 1,000 units of rare blood a year are supplied to recipients around the globe.

The Food and Drug Administration (FDA) requires the tracking of blood from "arm to arm," however this information is confidential and coded. Donors who test positive for HIV are notified and counseled. The consent form signed by donors asks if excess or expired blood may be used for research.

Fresh red blood cells have a shelf life of 21–42 days depending on the preservative used, and platelets have a shelf life of five days. Plasma can be stored frozen for one to five years, and frozen whole blood can be stored for at least 10 years. Platelets and red cells that expire are sold for research purposes. Researchers are informed that the samples have been found negative for all FDA required tests and only by special request may researchers be provided with the donor's age and gender. Plasma that cannot be transfused is used for making blood derivatives, such as Factor VIII for hemophiliacs, or for making diagnostic reagents. Nothing goes to waste.

Navy Blood Program

The Navy Blood Programs collect almost 150,000 units of blood per year. These units are stored for 35 days (like all blood). Also, 17,000 frozen units are kept on hand at all times. There is only a 6 percent expiration rate. A small amount of the blood that has passed the expiration date for transfusion may be used for research, but no specific program exists for supplying blood for

research purposes. Any blood that tests positive for a disease is destroyed and not used for research purposes.

Community Blood Bank

The Community Blood Bank of Erie County, Pennsylvania, was founded in 1966 and was initially established as a donor recruitment agency. In 1985, the Community Blood Bank took on the responsibility of collection, processing, testing and distribution of blood and blood products. The Community Blood Bank exists as a nonprofit organization with the mission of providing a safe and adequate supply of voluntarily donated blood for patients in Erie County. The Community Blood Bank is the sole supplier of blood and blood products to Erie's six hospitals and to blood centers across the United States in need of emergency blood and blood products. The Community Blood Bank is an accredited AABB member.

Thomas Jefferson University Hospital Blood Bank

The Thomas Jefferson University Hospital Blood Bank is the oldest blood bank in the Philadelphia area. About 25 percent of all blood and blood components transfused at Jefferson are collected through the donor center (volunteer, autologous, and directed donors), and the remainder is obtained from the American Red Cross. The blood bank consists of four divisions: the Donor Center, Transfusion Unit, Pheresis Center, and Tissue Typing Laboratory. The blood bank is an accredited AABB member.

Blood Bank of Alaska, Inc.

The Blood Bank of Alaska, Inc., is a nonprofit organization established more than 25 years ago that serves 30 regional medical centers and hospitals. The blood bank offers services, including autologous donations, directed donations, platelet apheresis, allogeneic donations, and therapeutic phlebotomy. The Blood Bank of Alaska, Inc., is an AABB member.

New York Blood Center

The New York Blood Center (NYBC) has been in operation for more than 30 years. The NYBC is the nation's largest independent blood distribution and services organization, providing blood and blood products for more than one million transfusions annually, about 10 percent of the nation's blood supply. The NYBC serves more than 200 hospitals in New York, New Jersey, and Connecticut. The Lindsley F. Kimball Research Institute is housed in the NYBC and

is a leading center for basic and applied research in hematology and transfusion medicine. The institute consists of 18 research laboratories committed to the study of blood and the prevention, treatment, and cure of bloodborne and blood-related diseases. NYBC also operates a Placental Cord Blood Program, and, since 1993, more than 500 transplants have been performed using cord blood provided by NYBC's Cord Blood Program. NYBC is a not-for-profit corporation and is an AABB member.

Puget Sound Blood Center

The Puget Sound Blood Center and Program was founded in 1944 and is the major resource for blood, tissue, and specialized services in the western Washington area. The Blood Center serves patients in more than 70 hospitals and clinics with blood services and provides tissue and transplantation support through the Northwest Tissue Center to 185 hospitals across the northwest United States. In 1997–1998, there were more than 170,000 volunteer blood donors. The Blood Program also maintains a research facility recognized internationally for advancements in transfusion and transplantation medicine.