

# 1 Histories of Tissue Banking

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The health of a boy who had suffered a deep burn to his lap deteriorated to such an extent that it was feared he would not survive. As a last resort, James Barrett Brown (1899–1971), a pioneering and influential American plastic and reconstructive surgeon, covered the wound with skin taken from the child's mother. The grafts "took" initially but after three weeks had been completely absorbed. Nonetheless, the child's health recovered and the wound was much improved [1]. Mother and child were fortunate in this instance: from the mid-1930s, when surgeons began following Brown's lead in using skin as a biologic dressing, more often than not, a mother recovering from surgery to remove her skin would be mourning the death of her severely burned child.

Skin taken from family members was the first choice in homografting<sup>1</sup> because surgeons believed it would be better tolerated than the skin of strangers, and also because anxious relatives were more likely to agree to undergo the painful procedure. However, skin occasionally was recovered from friends especially where the patient's burn covered a large area. Harold Gillies (1882–1960), a surgeon famous for his pioneering plastic reconstruction of soldiers horribly wounded during the First World War, described how factory hands offered their skin to dress the burns of a colleague who had fallen into a vat of boiling water. As a result, as Gillies put it, the patient became "the proud possessor of a part of the legs of Lucy and Annie, and so on, all the way up his legs" [2].

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<sup>1</sup> Homograft and allograft describe a graft of tissue from another person. Autograft is a graft using the patient's own tissue.

A 22-year-old man's severely inflamed corneas reduced his sight to such an extent that he was unable to count fingers held up close to either eye and needed help to find his way about. In 1930, at Guy's Hospital, London, Tudor Thomas (1893–1976), the Welsh ophthalmic surgeon who pioneered keratoplasty (corneal grafting) in Britain, grafted onto his patient's left eye the cornea of another patient, a 42-year-old man whose eye had had to be removed as a result of a perforating injury. Two years after the operation, the young man could count fingers on a hand held up three feet away from him [3].

Tudor Thomas was following in the footsteps of Eduard Zirm (1863–1944), who, in December 1905, in a hospital in Olomouc (now in Moravia in the Czech Republic), had performed the first human-to-human corneal transplant to “take”. The “donor” was Karl Brauer, an 11-year-old boy, a patient of Zirm's, whose eye had had to be removed because it had been penetrated by a fragment of iron. The recipient was Alois Golgar, a day laborer, another of Zirm's patients, who had been blinded in both eyes by a splash of the lime he had been using to whitewash a chicken hut. Golgar regained and retained some sight in one eye until his death some two-and-a-half years later.

### **Prehistory**

The prehistoric age of human tissue banking began around the turn of the 20th century. It was characterized by the “direct method,” which required physicians and surgeons to redistribute tissue among patients or to solicit grafting material from a patient's family and friends and sometimes from strangers. The direct method is responsible for the creation of a new category of person called a donor; it forged novel relations among both doctors, and patients. Its drawbacks emerged rapidly during the experimental phase of blood transfusion, one of the first therapeutic applications of human tissue (blood is liquid tissue), in which donor and recipient were connected arm to arm in order to prevent blood from coming into contact with air and clotting. The method placed considerable physical demands on the donor and was unreliable: doctors were unable to predict if a “donor-on-the-hoof” would belong to the same blood group as their patient.

Doctors in the first decade of the 20th century found that blood collected in a solution of citrate and glucose did not clot and kept for several days if it is stored in an ice box. However, it was not until the Spanish Civil War (1936–1939), when doctors on both sides were confronted by casualties on a mass scale, that the extended shelf life was exploited to separate donor and recipient in both time and space – the indirect approach. Civilians were recruited as donors and their blood groups identified. Blood collected

in a solution of citrate and glucose was dispatched in heat-insulated wood or canvas boxes, with thick cord linings, to field hospitals near the front line [4]. Its history was recorded on standardized forms.

Bernard Fantus is reputed to be the first person to have adapted the indirect method of blood transfusion to a peacetime context. In 1937, he established a facility at the Cook County Hospital in Chicago. Blood was collected in a flask containing a small amount of sodium citrate; the flask was sealed and stored in a refrigerator. Fantus called the facility the Blood Preservation Laboratory, but given the system of deposits and withdrawals, he soon came up with “blood bank,” a snappier name that immediately became part of the popular vocabulary [5].

Around this time, the indirect method began to be adapted to other kinds of human tissue. The first one was what would now be called an eye bank and was established in Odessa by Vladimir Petrovich Filatov (1875–1956), the Soviet Union’s premier ophthalmologist. Filatov, in 1929, had declared war on corneal blindness and had invited its victims throughout the USSR to come to his clinic for treatment. They turned up in droves. When hospital mortuaries in and around his clinic in Odessa proved unable to satisfy the demand for cadaver eyes, Filatov arranged for eyes to be collected in the Sklifosovsky Institute, Moscow’s central hospital for accidents and emergencies [6]. Many people died there. It was the city’s central trauma hospital and had thousands of beds and dozens of operating theaters. Filatov designed a convenient method of packaging eyes for safe transport known as moist storage, which consists of a widemouthed container usually made out of glass with some sort of device for securing the eye in its base and which is filled with an appropriate storage medium [7]. The containers were placed in a small ice-filled thermos jug, which was fitted into a box marked with a red cross and sent by rail. The eyes reached Filatov’s operating theater in Odessa some 500 miles away within the time allowed.

## **Histories of tissue banking**

This chapter is called “histories of tissue banking” because no two tissue banks are identical. Some of the variation can be attributed to the type of tissue handled, but differences between banks handling the same body parts can only be explained by where, when, and by whom the banks were established and developed. Each bank has favored certain techniques over others and has established unique relationships with its sponsors, the state, the market, the healthcare system, doctors, donors and their kin, and recipients.

This brief and partial survey offers some snapshots illustrative of the history of banks of tissue recovered mostly from what are now called

“non-heart-beating donors” within hours following death.<sup>2</sup> However, whereas blood banks rapidly replaced the direct method of blood collection, it has taken around 50 years for tissue banks to monopolize the recovery and supply of human tissue largely because surgeons could easily accumulate “stashes,” that is, personal collections of human material recovered in either the operating theater or the mortuary.

Early experimental grafts mostly involved tissue taken from living people known to the doctor or the patient. Tissue was seldom recovered from a corpse, and then only by a bold surgeon confronted by a desperate situation. Doctors were acutely aware of the speed at which bacteria proliferate in the corpse and were understandably fearful of the medical consequences of grafting cadaver material into a living patient. It had taken considerable courage on the part of Filatov to begin grafting corneas recovered from corpses. As he put it, “I must confess that I undertook the operation with some trepidation since there were those who warned me of the danger of ‘cadaver infection’, ‘cadaver toxin’, etc.” [8].

Another reason people were reluctant to recover tissue from the cadaver is that it necessitates intervening in powerful and carefully orchestrated rituals staged around death and disposal of the corpse and which speak of solicitude for the dead person and sympathy for the grieving relatives and friends. These rituals, which are observed in some form or other everywhere, also manage the liminal period between death and disposal, a period during which the corpse suffers from categorical ambiguity, a dangerous condition marked by competing claims of custodianship [9]. The competition is widely understood as a battle between death and living people reluctant to relinquish their ties with the person embodied in the corpse. Tissue banking is responsible for introducing a radical and dehumanizing claim: it seeks custodianship of the corpse in order to dismantle it into exchangeable and transplantable parts.

Tissue banks, confronted by written and unwritten rules that police the proper performance of these rituals, have placed as much importance on “cultural work” as on “organizational work” [10]. “Organizational work” is shorthand for the technical and administrative tasks involved in recovering, processing, storing, and distributing human tissue and includes practical arrangements for gaining custodianship of the corpse. “Cultural work” includes the development of official and quasi-official policies around the custodianship of the corpse and creating opportunities to give by fostering

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<sup>2</sup> “Non-heart-beating donors” are people whose death is confirmed by absence of vital signs such as heartbeat and respiration. “Brain death” is controversial and is defined by signs of irremediable damage to the brain stem. It was introduced in 1968 by an ad hoc committee convened by the Harvard Medical School. It has been deployed mostly to facilitate the recovery of solid organs during the warm ischemic time. See M. Lock, *Twice Dead: Organ Transplants and the Reinvention of Death* (Berkeley: University of California Press, 2002).

habits of the heart and generating accounts of what giving means. Cultural work, which seeks legitimation by the state, is political. It seeks a high public profile, whereas organizational work has been undertaken mostly out of public sight for reasons of expediency, discretion, and taste.

## **Organizational work**

Recovering tissue in the prehistory of tissue banks was a craft skill involving surgical instruments. James Barrett Brown, for example, used a very sharp knife of the amputation variety to cut thick, split-skin grafts. He was very adept and could vary the depth of cut according to the site. As he put it, “with some practice the thickness can be easily graduated with free-hand-cutting, and the thickness of the graft should depend on the relative full-thickness of the skin of the area . . . The essential thing is that it be cut thick, but not too thick, to prevent the donor site from healing promptly” [11].

Nowadays, tissue banks produce and distribute consistent, standardized interchangeable body parts, which can be employed uniformly across various institutional and even international boundaries [12]. Yet, in its infancy, tissue banking had been confronted by resounding proof that everyone is unique. Peter Medawar (1915–1987), a British scientist, in the 1940s and 1950s, established that rejection of “foreign” grafting material is an immunological response acquired during pregnancy. His biological “laws” of transplantation earned him (and Sir Macfarlane Burnett) a Nobel Prize in 1960. Medawar identified what he called a spectrum of affinities, with autografts at one end and a gross disparity between the donor and the recipient at the other. Research and clinical experience has allowed the various bodily tissues to be arrayed along the spectrum with corneas, which were found to be immunologically privileged, placed toward the autograft end, and skin, which is exquisitely susceptible to rejection, at the other. The spectrum has influenced the product “niches” into which various bodily tissues fall so that corneas are normally treated as universal replacement products, whereas unprocessed skin serves as a temporary biological wound dressing.

Tools capable of producing a uniform “product” out of nonstandardized human bodies were invented spasmodically. Von Hippel (1867–1939), a doctor working in Heidelberg, led the way by designing a trephine, a mechanized clockwork instrument with saw-like edges – like a tiny cookie cutter – which can cut identical disks about the size of a shirt button out of both source and recipient eyes. He used it for the first time in 1887 in an operation to replace a young girl’s corneas with those of a rabbit. The first dermatome, a calibrated device for removing skin in a uniform, predetermined thickness, was designed in 1937 by Earl C. Padgett Senior. The Reese

dermatome, developed during the Second World War, was a refinement, which allowed even better results. Harry Brown, a young American surgeon, conceived of the idea of an electric dermatome while being held captive in a Japanese prisoner-of-war camp.

Calibrated tools can be and are used successfully by a suitably trained lay person. The United States Navy Tissue Bank offered four-month-long courses in tissue recovery – “bone bank school” – to navy corpsmen [13]. The bank had been opened in June 1949 in the Naval Hospital, Bethesda, Maryland, the flagship of navy medicine, which treats sailors and their families. (Military medicine in the United States is socialized medicine: health care paid for out of taxation is provided free at the point of delivery according to the patient’s need.) The bank was the brainchild of George Hyatt, an orthopedic surgeon investigating bone preservation. Hyatt had found salvaging bone removed during surgery on “clean” orthopedic cases a time-consuming method of collection, which also provided scant material for his research. Cadavers were the answer: the bank’s motto was *Ex Morte Vita* – from death comes life. Dead bodies deteriorate rapidly and the time allowed for tissue recovery is brief. And the moment of death is notoriously unpredictable. Hyatt organized a round-the-clock rota of four or five trained technicians ready to recover tissue when a suitable patient died in the Naval Hospital. Dismantling a cadaver into up to 125 grafts of all types took 12–14 hours and involved 5 hampers of linen, 50 gowns, 400 towels, 200 sheets, and a host of miscellaneous material including 500 wrappers [14]. As a mark of respect for the dead person, talking was prohibited and hand signals were used for communication.

In the 1970s, American funeral directors and licensed embalmers were identified as people well placed to enucleate eyes from corpses. They are often the first professionals to arrive at the deathbed; they know how to manage the corpse’s liminal state, and they undergo training in anatomy and surgical techniques at an embalming school. However, many legal jurisdictions stipulated that enucleation, a surgical procedure, must be performed by a licensed medical practitioner. Lay organizations, especially chapters of Lions Clubs International, lobbied state senators to change the law and, when they succeeded, offered training courses to lay people.

## **Expansion of tissue banking**

Tissue banks are often lay rather than medical operations. Their workforce, both paid and volunteer, occupies a lower – and cheaper – rung of the occupational hierarchy than that of solid organ recovery, which is the province of transplant surgeons, medical elite. Lay people, particularly in the United States, have actively promoted and supported tissue banks with both cash and kind. As members of lay organizations, they have raised funds to

build facilities and buy equipment, and they have sometimes volunteered to recover tissue, complete paperwork, manage finances, or ferry tissue from donor to recipient. Often, organizations have championed a particular body part. Lions favored eyes because their grand endeavor is sight conservation and improving the quality of life of people with impaired sight, whereas adoption of skin banks by the Ancient Arabic Order of the Nobles of the Mystic Shrine – Shriners – grew out of their hospitals, which provide free orthopedic and burn care to needy children (toddlers in peacetime are the chief victims of drastic burns). British lay organizations, working within the framework of the National Health Service (NHS), have made a smaller but occasionally significant contribution to tissue banking. The Iris Fund, for example, a London-based charity devoted to medical research into the prevention of blindness, is responsible for the passage of the Corneal Tissue Act in 1986, which allowed lay enucleation. Since it was placed on the statute book, over 300 lay people have been trained in eye recovery.

War, both hot and cold, drove the expansion of tissue banking. Modern weaponry exploits heat to wreak physical havoc on the sentient tissue of the human body. There were burns caused by incinerating materials (such as napalm and phosphorous munitions), flash burns, flame burns, contact burns from hot objects on the battlefield, and scalds from steam or hot fluids (sailors were especially susceptible to these). New weapons were developed during the Second World War such as the American-made bazooka – a warhead propelled by a rocket – that could inflict both multiple, penetrating wounds and deep burns caused by small particles of burning material [15]. Modern medicine has found ways of increasing the chances of survival of appalling injury through better control of shock. As a result, the call to arms demands bravery in the face of weaponry and fortitude in the drawn-out painful process of bodily reconstruction, which often involves the incorporation of foreign tissue [16].

Medawar's early investigations into what he called "the body's exquisite powers of discrimination" were his contribution to the war effort during the Second World War. He had begun directing his energies toward understanding the science of skin grafting after witnessing a Royal Air Force bomber burst into flames and crash into the garden of his neighbor in north Oxford. The crew was badly burned [17]. Likewise, the Navy Tissue Bank was established in 1949 as a research facility investigating how cadaver tissue might be transformed into stable medical consumables that can be used in hospitals close to the battlefield. It promoted freeze-drying, lyophilization, or drying by sublimation, because freeze-dried tissue retains its original form, is easy to store, "keeps" at room temperature, can be stockpiled in preparation for mass casualties, and, like instant coffee, is easily reconstituted by immersion in a suitable fluid. The technique had been developed by Earl Flosdorf, who, during the 1930s, in his laboratory at the University of Pennsylvania's School of Medicine, had experimented with freeze-drying of human blood.

Flosdorf, during the Second World War, had transformed what he called a “laboratory curiosity” into a reliable supply of blood plasma organized by the American Red Cross to treat American troops injured in battle overseas. Shortly afterwards, he succeeded in applying the technique to the production of penicillin on an industrial scale [18]. When the Navy Tissue Bank opened, he collaborated with Hyatt in experiments on freeze-drying bones, skin, dura mater, arteries, and other human tissues incorporated in the restoration of servicemen injured on the battlefield.

The bank created a stockpile of freeze-dried tissue ready for use in the event of a situation that would produce mass casualties. Nuclear warfare, during the Cold War, was an everyday possibility, but the estimated scale of civilian casualties was well beyond the scope of medical facilities that would be up and running in the aftermath. The bank’s preparedness for service is suggested by photographs of shelves holding row upon row of small glass jars containing freeze-dried tissue, which illustrate articles describing its work. It found plenty of opportunities for testing the performance of its products close to the battlefield in the Korean War (1950–1953). The high casualty rate of the latter years of the Vietnam War (1959–1975) depleted the bank’s stock of tissue to such an extent that a second recovery facility had to be opened at the Naval Hospital, San Diego.

The United States, in the aftermath of the Vietnam War, entered a new era of isolationism and antimilitary politics. Stockpiles of freeze-dried human tissue were no longer necessary, and the bank turned its attention to organ and bone marrow transplantation. Nonetheless, its impact on tissue banking in the United States was considerable. The bank, during the brief interlude of peace that separated the Korean and Vietnam Wars, had stimulated civilian demand for tissue by distributing its products to surgeons who were prepared to test them out on their patients. New uses for tissues were identified, and training in procedures involving human tissue products began to be incorporated in the medical curriculum.

The Navy Tissue Bank’s alumni of trained technicians, on their return to civilian life, used their expertise in recovery techniques to either gain employment or set up their own tissue bank. Tissue banking in the United States, during the 1970s, developed into a cottage industry made up of surgeons’ stashes, “casual” small-scale efforts at local hospitals, a few large formal banks attached to major medical centers, and some independent outfits operating within a region [19]. They all fell outside the frameworks regulating licensed medical practitioners, pharmaceuticals, biologicals, and medical consumables. In contrast, at this stage very few tissue banks had been established in the United Kingdom, where policy makers, fearful of the consequences of adverse publicity on public trust in the NHS, encouraged surgeons to rely on stashes [20]. Associates of the Navy Tissue Bank, worried by the haphazard and unregulated spread of tissue banking, were responsible for the founding in 1976 of the American Association of Tissue Banks



(AATB). The AATB is a not-for-profit organization committed to ensuring the safety and quality of the supply of human tissue through establishing standards, training, peer review, and accreditation [21]. Membership and adherence to guidelines is voluntary, but the evolution of their standards has become the basis for tissue regulations in the United States and elsewhere.

Fear of cadaver toxin had virtually disappeared. The general rule was to exclude people known to have had an infectious disease, malignancy, or autoimmune disease at the time of death. A history of malaria, syphilis, viral hepatitis, tuberculosis, or death associated with an overdose or poisoning were also grounds for exclusion. However, criteria were rather vague, and there was little in the way of a formal system of oversight. The AATB encouraged the production of safe and usable tissue among its members by tightening up the criteria of donor suitability and establishing standards for training of personnel and adequacy of facilities.

## **Cultural work**

Doctors at the Sklifosovsky Institute, Moscow, were the first to recover cadaver tissue on a significant scale, when, during the 1920s, they began experimenting with transfusions of cadaver blood [22]. The cultural work that confronted them was light. They practiced medicine inside a totalitarian regime, which struggled to protect and prolong human life while simultaneously demonstrating a wanton disregard toward it [23]. The Soviet state under Stalin's dictatorship established a nationwide system of hospitals and clinics where health care was provided free at the point of delivery to all its citizens – who, at the same time, were being murdered or starved to death in millions.

In the United States, between the two World Wars, capital punishment was the principal source of fresh cadaver tissue. R. Townley Paton (1901–1984), a New York ophthalmologist with a flourishing and fashionable private practice, during the 1930s, honed his grafting skills by transplanting onto his patients' eyes corneas recovered from the eyes of men executed in the electric chair in Sing Sing Prison. A priest sought the agreement of the condemned men, Paton witnessed their death, enucleated their eyes, and, if their corneas were not used that day, stored them in his kitchen refrigerator. His son recalled how this method of storage almost led to the loss of the family cook, who was horrified to find containers filled with eyeballs on the shelf next to the milk bottle [24].

Adverse publicity put a stop to Paton treating executed men as a source of corneas (but did not lead to the abolition of the death penalty). Paton, in 1944, opened the Eye-Bank for Sight Restoration, America's first eye bank. The name capitalized on the popularity of blood banks during the war.

But New York state regulators initially refused to incorporate a not-for-profit organization called a bank on the grounds that it might mislead members of the public into thinking it engaged in financial transactions. They acquiesced when Paton agreed to hyphenate its name.

In direct donation, living donors are immediately rewarded by knowing the identity of whom they are helping and how their tissue is used. In the infancy of tissue banking, it took an effort of imagination to conjure up the reasons why during one's life one should pledge parts of one's corpse to strangers. The J. Walter Thompson Advertising Agency, the world's first and then leading advertising agency, advised the Eye-Bank on how to persuade the general public to volunteer. It faced a considerable task: Americans had to be introduced to the radical new idea that their bodies are made up of interchangeable body parts, and that eyes can "outlive" their current "owner" and restore the sight of hitherto blind strangers. The approach it pioneered, and which has been copied many times since, hid the messy thick reality of enucleation behind euphemisms with religious overtones. The Eye-Bank's first promotional leaflet compares eye donation with divine gifts: "God gave man sight at birth, and man now has sight in his gift to give to another" [25]. Put another way, sentiments associated with the "gift of sight" are, like Mother's Day cards and Easter eggs, a marketing innovation, one which encourages donation of tissue without any reference to how or from whom it is typically recovered.

The Eye-Bank provided would-be donors with cards, small enough to fit into a purse or wallet, on which they could record their pledge. Pledge cards, but not Madison Avenue marketing techniques, were adopted by Archibald McIndoe (1900–1960) when he opened the first British eye bank in 1948. McIndoe, a New Zealand-born plastic surgeon, before the Second World War, had built up a thriving and fashionable practice in London's Harley Street. During the war, at the Queen Victoria Hospital, a small cottage hospital in East Grinstead in the southeast corner of England, McIndoe had begun the painful and painstaking plastic reconstruction of the face and hands of "Britain's finest," the young aircrew and ground staff who suffered drastic burns in the war against Nazi Germany. Many lost their eyelids and suffered damage to the cornea. In 1947, a corneal transplant unit was attached to the burns unit, and Benjamin Rycroft (1902–1967), an ophthalmic surgeon, who, before the war, had gained some experience in corneal grafting, was appointed. Rycroft began grafting corneas recovered from the eyes of corpses in the hospital mortuary, but they were few and far between: the most he retrieved was four in one week, and, at that rate, it would have taken him at least three years to clear his waiting list. The problem was people who lived in the hospital's vicinity tended to die in their own beds, where no one thought of retrieving their eyes. What McIndoe called an eye bank was mostly a public relations exercise albeit one couched in medical terms.

## Giving and taking

The hospital issued pledge cards with a set of instructions which, among other things, advised that the card had to be held separately from a last will and testament, which is read several days after a death, usually following burial or cremation of the body and certainly too late for corneas to be usable. The scheme, in effect, envisaged “donors” as people who would make appropriate arrangements for the redistribution after their death of personal effects such as money, paintings, and jewelry. It exposed a legal vacuum: eyes pledged for the purpose of grafting fell outside the law on bequests because eyes, like every other part of the human body, are not personal effects and no one can determine what shall happen to them after their death.

East Grinstead lies west of Royal Tunbridge Wells, the spiritual epicenter of middle England. Many of its residents opposed the collective egalitarian principles embodied in the postwar welfare state. They rallied round McIndoe, a seasoned fighter against bureaucracy, and supported his campaign for an amendment to the 19th-century Anatomy Acts, which allowed the donation of corpses to medical schools for teaching and research but did not encompass body parts donated for grafting purposes. Their principal opponents were civil servants in the Ministry of Health fearful that publicity encouraging cadaver eye donation would exacerbate people’s fear of hospitals as places where few patients left alive, a fear reputed to be widespread in older people. Nonetheless, McIndoe won. In May 1952, the Corneal Grafting Bill was passed by the House of Commons.

The Corneal Grafting Act allowed people to bequeath their eyes during their lifetime either in writing at any time or during their last illness orally in the presence of two or more witnesses. It was a “donation statute.” From the mid-1950s onwards, American states began enacting donation statutes that authorized antemortem pledges of cadaver eyes and other body parts – mostly skin and arteries – for medical purposes. American donation statutes explicitly served an additional purpose: they were designed to protect whoever recovers cadaver tissue from an action for damages by distressed relatives. Next of kin in the United States have a common-law right of possession of the dead body, in the same condition as it was at the time of death, for the purposes of burial or other disposition. This right originated in considerations of love, reverence, domestic relations, and blood ties and is sometimes called a quasi-property right [26], although strictly speaking the human body is not property; also, the right is limited to burial: it does not allow, for example, the next of kin to sell the cadaver, but it does permit them to bring an action for damages for intentional, reckless, or negligent removal of cadaver body parts.

The Uniform Anatomical Gift Act (UAGA) 1968, a landmark in the history of tissue banking, is a donation statute. It was drafted during an era concerned with guaranteeing the civil rights of every American adult and

celebrates individual autonomy, that is, the right of every citizen to do with his or her body as he or she sees fit. The dead person has the first and deciding voice as long as his or her intentions have been recorded by means of a pledge written and signed in the presence of two witnesses. The pledge in effect disentangles the corpse from inconvenient ties of love and kinship: next of kin cannot abrogate it. The UAGA also, paradoxically, grants the next of kin the right to authorize a donation where no pledge is found. By 1971, the UAGA had been adopted, usually in a modified form, in every state and the District of Columbia.

The UAGA's exceptional popularity was stimulated by enthusiastic media coverage of improving rates of survival in kidney transplants, which had followed the discovery of powerful drugs for immunosuppression in the early 1960s. Before then, with the one exception where donor and recipient were identical twins, the procedure was fatal and almost never performed. The first time a cadaver kidney was transplanted was in 1962 at the Peter Brent Brigham Hospital, Boston. The British Human Tissue Act 1961 was introduced to fill a legal vacuum in relation to the recovery of arteries, skin, and other grafting material from cadavers. The Act allowed people to pledge one or several parts of their body to be used after their death. In other words, it allowed people to "opt in." It also allowed them to "opt out," but in making no provision for how this might happen, it was almost impossible for anyone who wanted to opt out to do so.

The Human Tissue Act 1961 was only partially a donation statute. The section under which most cadaver material was recovered was the one allowing the person in lawful possession of the body to authorize the removal of body parts if, having made such reasonable enquiry as may be practicable, they had no reason to believe that the deceased in his or her lifetime had expressed any objection to it or that his or her surviving spouse or any surviving relatives objected. In including no sanction or punishment of transgressors, the Act effectively insulated the person lawfully in possession of the body, a legal person, usually a hospital manager, from threat of prosecution.

The Human Tissue Act 1961 promoted an ethos within NHS hospital operating theaters and mortuaries of taking without asking, that is, of treating human tissue as waste freely available as salvage. "Taking statutes" in the United States were organized around medical examiners and coroners' cases, that is, around people who die in unexpected or suspicious circumstances. American law allows the withholding of body parts removed during a postmortem examination that might yield forensic clues, but it did not provide for the recovery of cadaver tissue for therapeutic purposes. An action for damages following taking without agreement of the next of kin might succeed.

Baltimore is usually near the lead in the annual competition for murder capital of the United States. Russell Fisher, the Chief Medical Examiner of

Maryland, was a busy man. He was also a transplant enthusiast eager to add to the public good by assisting the Medical Eye Bank of Maryland (MEB) secure more transplant material [27]. In 1975, Fisher and Frederick N. Griffith, Executive Director of the MEB, persuaded Maryland senators to pass what became known as the “Medical Examiner’s Law,” a statute which allows a medical examiner to agree to the removal of specified body parts from a corpse within his jurisdiction where no objection from the next of kin is known.

The Act introduced what is sometimes called implied or presumed consent, that is, anyone whose death is brought to the attention of a medical examiner is presumed to have agreed to tissue recovery, unless he or she has registered a refusal or his or her next of kin explicitly disagrees. In practice, the circumstances under which a corpse typically falls into the possession of a medical examiner make it unlikely that his or her next of kin will raise an objection. It is more appropriate to call presumed consent a legislative consent because the statutes provide the state embodied in the legal person of the medical examiner with complete authority to agree to, or refuse to, cooperate with a tissue bank.

The law’s treatment of the cadaver as a resource is inconsistent. The United States has resisted efforts to move to legislative consent with respect to solid organ donation precisely because it values the right of citizens, or their families as surrogates, to give such a gift and enjoy the associated moral benefit. Nonetheless, legislative consent statutes were introduced in many states in the 1970s and 1980s but most allowed recovery only of corneas and pituitary glands, then being collected in vast numbers for the extraction of growth and other hormones.

Taking without asking is responsible for some of the scandals that periodically have tarnished the reputation of tissue banks, because it abuses the sensitivities surrounding the corpse during its dangerous liminal stage. It takes advantage of public ignorance. The public outrage following the Lions Doheny Eye & Tissue Transplant Bank scandal revealed how few people associate the medical examiner’s office with authority to agree to tissue recovery. Few people associate a hospital postmortem examination with withholding of tissue for therapeutic or research purposes. In November 2000, Robert McNeil summed up the responses he had encountered during his 32-year-long career as a mortuary technician in NHS hospitals:

“There are members of the public who had a very clear idea as to what an autopsy was about and they could speak up for themselves, but in the main the majority of people I believe when a doctor asks can they carry out a post-mortem, the main thing that concerned the relatives would be was it going to cause any delay or can they see the body afterwards, and the answer(s) would be no and yes” [28].

McNeil was commenting on the so-called Alder Hey scandal that followed the discovery in 1999 of a large stash of babies' and children's body parts in the basement of the Royal Liverpool Children's Hospital, known locally – and affectionately – as Alder Hey Children's Hospital [29]. This gruesome news was shortly followed by the revelation that throughout the United Kingdom, it was customary for pathologists to withhold, without asking, body parts removed during a postmortem examination, a practice kept hidden from the public. The material was used mostly in teaching and research and to discourage doctors from “burying their mistakes.” But some tissue was also taken for a therapeutic purpose. The British government responded to the public's outrage by setting up a review of the law, which resulted in the passage in 2004 of the Human Tissue Act.

## Asking

Official policy nowadays emphasizes asking. Consent is described as the golden thread running through the English Human Tissue Act 2004. In the United States, a succession of policies has spawned a host of professionals trained in asking people confronting difficult and tragic circumstances to consider tissue donation. However, the scandals also suggest that public accounts of what giving means have failed to keep pace with developments in the tissue recovery industry. Put another way, cultural work provides an inadequate account of organizational work and has failed to keep pace with the radical changes it has undergone.

Tissue banks have transformed rare and sometimes desperate acts to save life or restore function into routine unremarkable procedures. However, whereas solid organs and corneas are counted both in and out, there are no reliable or published data on tissue banks' activity. Yet far more people provide tissue than provide organs. Of the estimated 1.2 million people who die in American hospitals each year, 11,000–14,000 of them die in circumstances that allow them to be an eligible organ donor. In contrast, at least 100,000 dead Americans meet the criteria of tissue donation [30]. Indeed, tissue was recovered from around 20,000 American corpses in 1999, a cohort far greater than that of 1994, which numbered around 6,000 [31]. How many British corpses “volunteer” is unrecorded.

Fear of cadaver toxins resurfaced in the 1980s in response to the threat of HIV transmission, which was followed by worries about other old and new infectious diseases such as malaria and variant Creutzfeldt–Jakob disease (vCJD). Risk of transmission is being reduced through the imposition of increasingly stringent criteria of donor eligibility organized around where a potential donor lived, his or her lifestyle, and where and how he or she died. Although criteria vary from country to country, tissue from a British corpse is almost universally unwelcome outside Britain because of the belief

it might harbor vCJD. What this means is altruism is no longer the only quality sought in a potential donor, a development which cultural work has not yet addressed.

What was once a cottage industry in the United States has become an industrial complex of often interconnected for-profit and not-for-profit organizations with a turnover in billions of dollars. The scope and size of each American bank varies from small local hospital-based programs providing one kind of tissue to regional or national organizations offering several different ones. In the United Kingdom, stashes have mostly been eliminated by the licensing arrangements imposed by the new Human Tissue Act 2004. A few banks provide one type of tissue such as cornea, bone, and heart valves, and the NHS Blood Service, since the early 1990s, has become the major source of bone, skin, and tendons and also provides heart valves.

Processing allows Medawar's laws of transplantation to be circumvented. It can make tissue that might otherwise be rejected into a universally acceptable product. The range of "products" has significantly increased, and diversification in the industry has substantially altered the profile of the typical recipient. The series of articles published in April 2000 in the *Orange County Register* revealed that tissue donated in response to requests emphasizing life-threatening situations, such as a drastic burn, could be diverted into frivolous applications such as puffing up the lips of fashion models or enlarging penises. Each corpse can provide as many as 50–100 "products," which means that hundreds and thousands of people are on the receiving end of them. Yet few are aware that their treatment originated in the mortuary.

People may feel cadavers are defiled when they discover they have been transformed into "off-the-shelf" products, sold at high cost through catalogs and by sales representatives. Processing has widened the gulf separating donor and recipient that characterizes the indirect method. However, advances in processing methods have also increased the usefulness of tissues and the safety of tissue transplantation. Imaginative and responsible cultural work is needed in order to ensure that beneficial developments are facilitated in an open and transparent way without exploitation of donors or donor families. It is crucial to remember that organizational work and cultural work are interdependent and that a tarnished reputation in one has repercussions in terms of public trust in the whole enterprise.

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