

A Brief History of Brain Archiving

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This paper narrates the history of brain archiving from the first experiments in the preservation of soft tissue in spirits of alcohol to the latest refinements in cryogenic technology. It argues that the archiving of human tissue is a practice as dependent upon the social relations of medicine as it is upon the technologies of the laboratory. In the seventeenth century the Dutch anatomist who was the first successfully to preserve soft tissue was able to purchase stillborn babies from the midwives whose work he supervised; a century later the proprietor of the most famous anatomy school in London had to depend upon body snatchers to furnish the raw material of his anatomical museum. For a hundred and fifty years after the French Revolution archives of human tissue would be derived from the indigent recipients of state medical care, but in the mid-twentieth century the social relations of medicine began once again to shift and present-day brain banks now depend upon voluntary donors from patient groups. The article follows the story of those changes, tracking the legal and ethical constraints and opportunities that have shaped tissue archiving in its 350-year history.

Using specific collections as exemplars of wider practices, the article is divided into four roughly chronological sections, corresponding to important shifts in the understanding of the brain in relation to aspects of the human condition. Section 1 examines some of the anatomy museums of the seventeenth and eighteenth centuries and the mind-body dualism embodied in their displays; the second section examines the role of the pathology museum in the emergence of a materialist, monist view of the human mind in mid-nineteenth century France; section 3 examines some of the ethical hazards of monism through the story of the search for visible signs of intelligence and character; and the fourth section narrates the twentieth-century emergence of therapeutic optimism as a rationale for brain archiving.

1. The Art of Anatomy, 1660-1789

The story of archiving the soft tissues of the human body must begin with Frederik Ruysch, chief anatomist for the city of Amsterdam in the mid-seventeenth century and the first person to perfect a method for preserving soft tissue. Ruysch's collection was dominated by *memento mori*: the preserved bodies of infants, stillborn but perfect, purchased from the midwives whose work he supervised in his official capacity as Amsterdam's Master of Midwives (Kidd and Modlin, 1999; Hansen, 1996). Although Ruysch's celebrated technical mastery of the art of anatomical injecting enabled him to make wonderful observations of the human brain, no preserved specimens of the

brain made it into the catalogue of his cabinet. The brain would have to wait until the next century to take its place in the anatomical museum.

An anatomy museum was an indispensable pedagogic tool of the private anatomy schools that sprang up in London, Paris, Edinburgh, and other centers of medical education in response to the gradual professionalisation of surgery. By the middle of the eighteenth century, nearly thirty of these institutions had been founded in London alone (Peachey, 1924, p. 8). The schools generated a brisk trade in specimens, with retired anatomy teachers' collections being bought and sold at public auction. The booming business of the private anatomy schools and its concomitant trade in anatomical specimens was shadowed by a sinister black-market economy in corpses, which were needed for educational dissection as well as for the creation of anatomical preparations (Richardson, 1987).

Owing to the softness of the tissue, the brain was extremely difficult to preserve, and many collections contained no archived brains. The most famous collection of the time, that of the anatomists John and William Hunter, did, however, include many brain specimens. In the last years of the nineteenth century, one John Teacher, an anatomist at Glasgow University, restored and catalogued William Hunter's museum, including nearly fifty preparations of the human brain. Most of these represent putatively normal, healthy brains, fixed, injected, dissected and mounted in order to reveal the internal architecture of this most complex of organs. Like the rest of his collection, William Hunter's brain specimens were in the main anatomical rather than pathological. Pathological specimens had not yet assumed the importance that they were later to enjoy (Teacher, 1900, pp. 318-19).

2. The Rise of Monism, 1789-1900

When the French Revolution of 1789 removed the hospitals from the hands of the Church into those of the state, the physicians of Paris seized the opportunity to develop a new, systematic, analytical medicine. The bodies of the French citizens who occupied Paris's twenty thousand hospital beds became the experimental material of a revolutionary diagnostics, based on the correlation of symptoms with the abnormal lesions or inflammations revealed by post mortem examination. This shift in the social relations of Paris medicine set the template for the next one hundred and fifty years of medical practice in Europe. Dissection was unlinked from criminal punishment, and, until the middle of the twentieth century, the principal sources for educational dissections and anatomical preparations were the unclaimed bodies of the indigent recipients of state medical care.

By the mid-nineteenth century, the preserved brains of various patients from the hospitals of Paris became key pieces of anatomico-pathological evidence in one of the most famous controversies in the history of neuroscience: the debate about localization (Jacyna 2000; Harrington, 1987). The collection that served as a repository for the brains in question was founded in 1834 by a legacy of the celebrated surgeon Guillaume Dupuytren. The museum was installed in the old refectory of the Cordelier Convent, where it brought together various collections that had been dispersed throughout the faculty of medicine (Orfila, 1842). It grew rapidly: the first catalogue, compiled between 1836 and 1842, listed about a thousand specimens; by the late 1870s the museum contained over six thousand pieces (Abelanet & Saint-Maur, 1991; Houel, 1878, p. 271). Using the Musée Dupuytren to store the brains of his aphasic patients, Paul Pierre Broca was able to secure acceptance of the doctrine of localization.

The systematic study of aphasia was considered highly subversive. The suggestion that human language had a material base struck a blow at the concept of human divinity. In 1868, during the authoritarian regime of Napoleon III, a major debate broke out in the French Senate, during which the embattled clergy and their right-wing allies accused the medical faculty of propagating rank materialism and denying the existence of the soul. The first systematic pathological collection of human brains in France played a role in the gradual establishment of a secular understanding of the human condition, a view for which the preserved brain might well stand as an emblem (Maurain, 1930, pp. 838-9).

3. The Problem of Premature Classification, 1871-1945

The debate about localization in which Broca famously intervened in 1861 had begun as a rather different discussion: his anthropological society wanted to determine whether or not there was any correlation between brain size and intelligence. Towards the end of the nineteenth century, the search for quantifiable biological markers of superior intelligence and character was assimilated into an imperial synthesis in the human sciences. As the European nations scrambled for colonies, and as their governments tried to face down the threat of homegrown socialist and feminist movements, the debate about brain size and intelligence gave powerful ammunition to those who wanted to claim that the social and political hierarchies of the imperial age had their basis in unalterable facts of nature (Hagner, 1999; Gould, 1996; Finger, 1994, pp. 299-315).

Two different kinds of brain collections were formed to investigate the question. For the first type, the unclaimed bodies of people who died in hospitals, asylums and almshouses were preserved and characterized on the basis of racial type. The second project consisted in collecting and preserving the brains of eminent men, often achieved through the setting up of 'mutual autopsy societies'. Investigations into the distinctive features of elite brains were conducted within the framework of a racial hierarchy, with Northern Europeans at the top and Africans at the bottom. The 1908 article, 'Some Racial Peculiarities of the Negro Brain', by the then instructor in anatomy at the University of Michigan, Robert Bennet Bean, attempted to show that 'there is a difference in the size and shape of Caucasian and Negro brains ...'. Bean's data were derived from his studies of several different brain collections. Many of the specimens were from the Anatomical Laboratory of John Hopkins University; some were from the University's Pathological Department; others were obtained through a Dr Page from the Baltimore City Alms House.

The search for the physical basis of 'racial character' reached its apogee, of course, in Second World War Germany. The doctrine of 'racial hygiene' asserted the primacy of genetic and biological factors in the determination of the most complex of human behaviours. With the aim of emptying hospital beds to receive wounded troops from the front, a committee of doctors was empowered to carry out 'mercy killings' on those people deemed unfit by the architects of the Third Reich. To operate the euthanasia program, six elimination centers were established in chronic care institutions, including one at the Brandenburg-Görden mental hospital, where the famous neuroscientist Julius Hallervorden acted as senior pathologist throughout the war. Altogether Hallervorden archived a total of 697 brains of children murdered with carbon monoxide gas (Peiffer, 1997).

4. The Emergence of Therapeutic Optimism, 1900-2000

The other form of brain archiving that got under way at the beginning of the twentieth century will be entirely familiar to people working with human brain tissue today – the collection based on a single disease entity. One of the best-characterized collections was an archive of the tissues excised from patients in the course of their treatment or at post-mortem by the American neurosurgeon, Harvey Cushing. At the time of his retirement in 1932, the archive consisted of approximately 2000 specimens – tumors from the operating room and whole brains from autopsies – plus nearly 15,000 photographic negatives, including photomicrographs of tumor specimens and photos of patients showing symptoms (Fulton, 1946).

The neurosciences blossomed after the Second World War, and with this growth of interest came a corresponding exponential expansion of brain archiving. In a recent census of tissue collections in the UK, for example, the Department of Health discovered that of the 54,300 organs retained in hospital pathology services and medical schools between 1970 and 1999, 23,900, or 44 per cent, were brains. In 'museum' collections, defined as those assembled before 1970 (and including one medical museum dating from the early nineteenth century), only one fifth of the whole organ specimens were brains (UK Department of Health, 2000).

In the 1960s, brain archiving underwent the greatest social, technological, and organizational

transformations in its two-hundred-year history. Brains began to be archived prospectively, rather than for specific research projects, with tissue samples made available upon application – the advent of brain ‘banking’. Brain archives also began to freeze the samples, with each specimen being exhaustively characterized.

In addition to the battery of high-tech procedures that set contemporary brain banks apart from their predecessors, the method of obtaining subjects changed in the 1960s and 1970s. Rather than obtaining material from the unclaimed bodies of the indigent recipients of state medical care, representatives of present-day brain banks speak at patient support groups, recruiting donors and controls pre-mortem from the ranks of the sufferers and their families (Tourtellotte et al., 1999).

The twenty-first-century brain archive is a bank, not a museum; the specimens are frozen as well as fixed; the material is gathered from donors recruited from patient groups rather than from the bodies of the poor. Each of these transformations seems to be interlinked, and each seems to imply an unprecedented level of therapeutic optimism. The transformation from a museum to a bank implies that the material is no longer a passive subject of display, but of active intervention. Other biomedical archives that are characterized as ‘banks’ make material available for treatment procedures, such as blood transfusions, organ transplants, skin grafts, and artificial insemination. In addition, the solicitation of tissues from the ranks of the groups set up to provide mutual support for sufferers from neurological conditions and their families must be predicated on the promise of a cure.

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