

## THE LEEDS MUMMY\*

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In 1974 Dr Rosalie David, the Keeper in Egyptology at Manchester Museum, gathered together a team of specialists from both medical and non-medical fields with the object of carrying out an in-depth study of the collection of Egyptian mummies in the Manchester Museum. Since then the author has taken an active role in the project, using the techniques of pathology in an attempt to detect evidence of disease in the material examined.

Three post mortem examinations have been carried out on Egyptian mummies in Manchester, the most interesting in 1975 when Mummy 1770 was unwrapped (Fig. 1).<sup>1</sup> The mummy was that of a child. Radiographical examination had shown that the legs had been amputated, but at *post mortem* it was found that the Ancient Egyptian embalmers had provided her with artificial legs and feet for use in the after-life. They had also put slippers over the feet. Moreover, there was a hard nodule in the abdominal wall which showed radiologically as a calcified Guinea worm. The female Guinea worm is about 30 inches in length and often migrates to the legs where it tends to cause ulceration. This was treated in Ancient Egypt (and until recently in some parts of Africa) by grasping the end of the worm as it emerged from the ulcer and wrapping it on to a cleft stick. It is believed that this treatment goes back to Biblical times: it has been suggested that mention of snakes or 'fiery serpents' in Numbers is, in fact, a reference to Guinea worm infestation and the method of treating it. A snake on a stick is incorporated into the emblem of not only the British Medical Association but also the Liverpool Medical Institution.

However, most post mortems are by their very nature destructive and Egyptian mummies are valuable antiquities which once destroyed cannot be replaced. (There are now, quite rightly, strict regulations on exporting antiquities from Egypt). For this reason and in order to examine a wider selection of material, other approaches have to be explored. Fortunately, the very methods used by the embalmers help pathologists to study disease in Ancient Egypt. On occasion, the organs were placed in canopic jars or merely left outside the body. Both of these practices have provided material which has been used to diagnose disease present in Ancient Egyptian society, as can be seen from the following two cases.

The first concerns material from one of the 'Two Brothers'. These mummies were unwrapped early in this century by Margaret Murry, at that time the Assistant Keeper in Egyptology at Manchester. Fortunately she left a piece of lung in a canopic jar; when the lung was examined under the microscope, changes were seen in it which indicated that the deceased was suffering from Sand Pneumoconiosis.<sup>2</sup> This is a disease caused by the

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<sup>1</sup> E.Tapp, '-The unwrapping of a mummy', in A.R.David (ed), *The Manchester Mummy Project* (Manchester: Manchester University Press, 1979), pp. 83-94.

<sup>2</sup> E.Tapp, A.Curry and C.Anfield, 'Sand Pneumoconiosis in an Egyptian mummy', *Brit.Med.J.*, vol.2, (1975), 276.

inhalation of fine particles of sand and is very similar to pneumoconiosis in coalminers and stonemasons. Whilst in some Ancient Egyptians the disease may have been occupational in nature, most, we believe, inhaled sand from the general environment. Dust storms were common in Ancient Egypt; anyone who has walked up from the Rest House in the Valley of the Kings, travelling by the Theban peak, to descend ultimately by the very precipitous path to Hatshepsut's Temple at Dehr el Bahri, will appreciate that it is not difficult to get sand particles in the lungs. (Further reference to Hatshepsut's Temple will be made later since it was close by here that the body of Natsef Amun was found).



**Fig. 1 The bandages being removed from the mummy 1770**

In the case of Asru, another mummy in the Manchester collection, the intestines were found placed between the thighs. When they were examined under the microscope, evidence of infestation with the *Strongyloides* worm was discovered.<sup>3</sup> This is a disease acquired by walking in water or soil infected by immature forms of the worm which penetrate the skin and eventually reach the intestines. It would be prevalent in a country where the land can be tilled only at the time of the inundation. It is interesting to see as one travels through Egypt in the present day that the inhabitants still expose themselves to this type of disease by wading and swimming in irrigation canals.

However, organs placed in canopic jars or alongside the mummy are not common and to examine the internal organs of mummies which have been left *in situ* (or, as in the case of Natsef Amun, been removed and then replaced), some technique is required whereby samples of tissue can be obtained without altering the outward appearance or destroying the integrity of the mummy. To do this, the Manchester group has developed a technique using medical and industrial endoscopes.<sup>4</sup> Whilst the usual routes into the body used by doctors via the mouth or anus, are not always available in Egyptian mummies (although it will be seen later that an endoscope was used to look down Natsef Amun's throat as far as his windpipe), Ancient Egyptian embalmers facilitated the use of the endoscope by removing the brain through the nose after breaking through the base of the skull with an iron hook. This provides a route through which an endoscope can be introduced and the inside of the skull examined. It has also been possible to take biopsies from residual brain in this way. The embalmers also helped by removing internal organs such as the lungs, thus providing a space in the body cavities into which an endoscope can be introduced (Fig.2). Hydatid disease in both the lungs and brains of different mummies has been found using these techniques.

It was against this background that the author and other members of the Manchester Museum team were asked to examine the Leeds Mummy, Natsef Amun. After a preliminary examination in Leeds, the mummy was brought over the Pennines to Manchester Medical School where the examination was carried out.<sup>5</sup>

It is known that Natsef Amun was alive in about 1100 BC at the time of Ramesses the Eleventh and towards the end of the New Kingdom. He was a Priest at the Great Temple of Amun at Karnak where he held the title of Keeper of the Bulls. His mummy was found at Dehr el Bahri near Hatshepsut's Temple in 1822. There is a record of the Italian Passalacqua sending it to Trieste in 1823 from where it went to London to reside briefly in the Egyptian Hall in Piccadilly. Some five years earlier, members of the scientific, manufacturing and commercial communities of the flourishing city of Leeds had come together to form the Philosophical and Literary Society. By 1821 they had sufficient funds to build the Leeds Philosophical Hall, one of the first purpose-built museums in Britain. Natsef Amun was one of the early acquisitions of this museum,

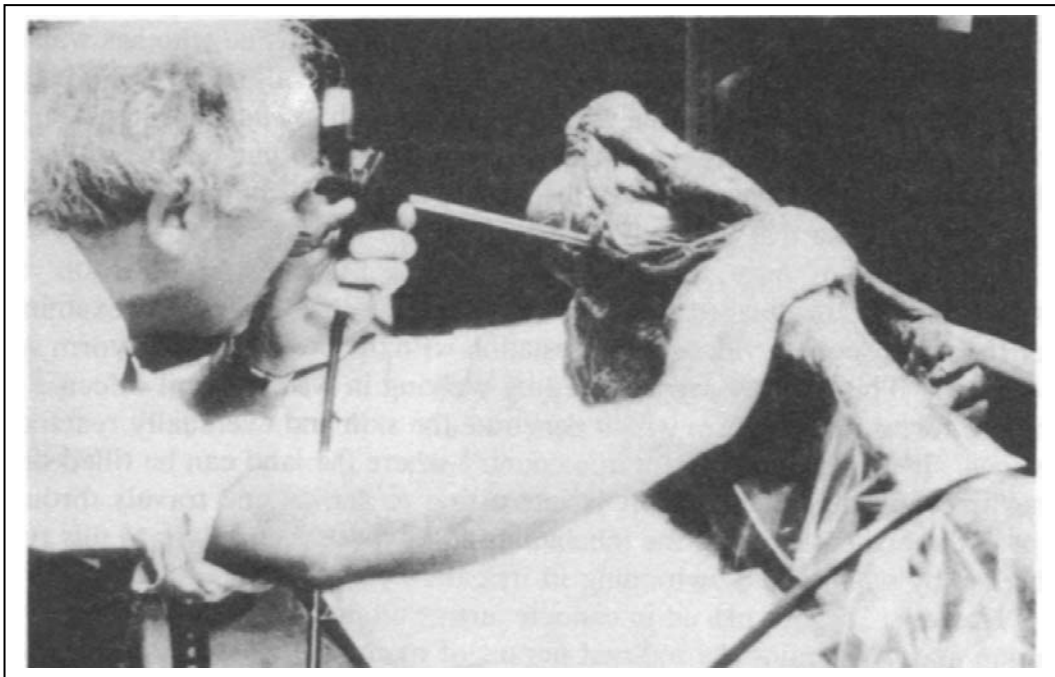
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<sup>3</sup> E.Tapp, 'Disease and the Manchester mummies — the pathologist's role', in A.R.David and E.Tapp (eds), *Evidence Embalmed* (Manchester: Manchester University Press, 1984), pp. 78-95.

<sup>4</sup> E. Tapp, P. Stanworth and K. Wildsmith, 'The endoscope in mummy research', in David and Tapp, *Evidence Embalmed*, pp. 65-77.

<sup>5</sup> E. Tapp and K. Wildsmith, 'The autopsy and endoscopy of the Leeds mummy', in A.R. David and E. Tapp (eds), *The Mummy's Tale* (London: Michael O'Mara Books, 1992), pp. 132-53.

being presented by John Blades, a wealthy banker of Park House, Leeds and Upton Hall, Upton. At this time it was not uncommon for groups of people to carry out unwrappings (or 'unrollings' as they were called) on Egyptian mummies. Many of these were done purely as an entertainment, but it was in an atmosphere of serious scientific investigation that several notables including the surgeon Thomas Pridgin Teale carried out the unwrapping and examination of Natsef Amun.<sup>6</sup> A certain John Marshall was also involved. A wealthy manufacturer and head of the Leeds flax spinning industry, he was one of the principal benefactors of the Philosophical Society. His enthusiasm for Egyptology is reflected in the Egyptian temple facade of Marshall & Company's flax mill in Holbeck, near Leeds, built in about 1838 and still standing. (The chimney, based on Cleopatra's Needle in London, has now been demolished).



**Fig. 2 A rigid endoscope being introduced into the back of the chest of the mummy**

At the time of the original investigation on Natsef Amun the techniques of histological examination of tissues were very primitive and the specialty of pathology in its infancy. X-rays, of course, had not yet been discovered; thus the original workers did not have the advantage of the twentieth century mummy team who were able to examine the body of Natsef Amun radiologically before starting the post mortem examination. Conventional radiographs were taken and Natsef Amun was put through the CT Scanner.

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<sup>6</sup> T.B. Teale and R. Hey, *An account of an Egyptian Mummy* (Leeds: Leeds Philosophical and Literary Society, 1828).

These examinations showed some osteoarthritis in his neck but no other significant abnormalities.

It is interesting to compare the findings of the 1828 investigation with those of the modern examination and see how the newer techniques, particularly histology, have allowed the earlier findings to be re-interpreted and extended. The original workers had removed the bandages from the face and neck and had cut and disturbed the ones on the trunk. They found what they called 'spicery material' between the bandages and the skin. This appeared to consist of fragments of wood and bark and it was clear that this material had prevented the skin from sticking to the bandages in the way that it can do when mummies have been embalmed with resin. As a result of this, the original workers could remove the bandages without pulling the skin off the surface of the body. The skin on the face appeared to be in good condition but examination of the skin under the microscope showed that the embalming technique had not preserved the outer layers of cells and that the structure of the epidermis was completely lost. On the other hand, the dermis of the skin was much better preserved and the tissues showed the same staining reactions that are found in modern tissue and not the reversal of the staining properties that have been found in mummies where liquid embalming material has soaked into the skin.

The original workers described the skin as being greasy to the touch. They discussed whether this was due to the fact that the Ancient Egyptians had used a waxy material when embalming the body, referring to Granville and to his conclusion that wax was used by the Ancient Egyptians in embalming<sup>7</sup>. Granville, a surgeon who unwrapped another mummy about this time, had suggested that the origin of the word 'mummy' lay in the Coptic word for wax 'mum'. (The usually accepted derivation of the word is 'mummiā', Persian for 'bitumen'). The other suggestion made in 1828 was that the greasy appearance of the skin could be due to the presence of adipocere in the tissues. The process of adipocere formation was not understood at the time but it is clear now that it is caused by the breakdown to fatty acids of neutral fats in the tissue. This can result in a quite amazing degree of preservation. The fatty acids can now be examined under the microscope and it is clear from histological examination of the tissues of Natsef Amun that some adipocere had indeed formed and that this was the explanation of the greasy appearance found in the 1820s.

As regards the external appearance of the mummy, the original worker noted that there was some compression of the forehead and the bridge of the nose; this they attributed to bandages being drawn tightly across the face while the tissue was still soft. These markings can still be seen and are certainly compatible with having been produced in this way (Fig.3). The nose was described in detail by the original workers who also identified the passage in the right nostril through which the brain had been removed. Unfortunately the nose has been broken off since that time and is missing. It is likely that this occurred in 1944 when the Leeds Museum was bombed and the glass case in which the mummy was housed shattered.

The lips were parted and the tongue protruded for some  $\frac{3}{4}$  inch beyond the teeth. The reason for this is not clear. The usual reason for the tongue protruding through the mouth after death is that it is larger than normal, but under the microscope there is no

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<sup>7</sup> A.B. Granville, 'An essay on Egyptian mummies: with observations on the art of embalming among Ancient Egyptians', *Phil. Trans. Roy. Soc.* (1825), 269-316.

evidence of disease processes such as tumour or inflammation which could have caused enlargement. On the other hand, the protrusion could be due to oedema. If this had been the cause, one would not expect it to be detected under the microscope as the very process of mummification would have extracted the fluid from the tissues.

The commonest cause of such oedema would have been an allergic reaction. This can be part of a generalised response of the body following contact with a substance such as a drug. More commonly it occurs as a local reaction to an irritant coming into contact with the tongue — in the present day bee or wasp stings are the commonest cause. If the swelling was due to oedema the possibility that this led to death by choking has to be considered.

Another cause for the tongue protruding after death is strangulation. There are no marks on the mummy's neck to suggest hanging or ligature strangulation, but manual strangulation can leave little in the way of marks and cannot be excluded in this case. With this in mind, therefore, the powdered material that was still in the mouth and throat was sucked out with a vacuum cleaner and a good view down the back of the throat obtained with the endoscope (Fig.4). Using this technique it was possible to confirm that there were no abnormalities at the back of the tongue and no evidence of injury to the voice box to suggest strangulation.



**Fig. 3 The Leeds Mummy**

The eyes had been noted in the original examination as being present but sunken into their sockets. There had not been any attempt by the embalmer to supply prostheses. (A number of objects were used for this purpose: it was discovered several years ago that

small onions had been placed in the eye sockets of Ramesses IV). It was possible to remove the eyes and the optic nerve intact. The optic nerve is essentially an extension of the brain to the eye and consequently does not have the structure of a normal nerve. It was well preserved in the case of Natsef Amun and showed no significant abnormality under the microscope. In the very few other instances where the optic nerve from Egyptian mummies have been examined, the nerve has always been reported as being poorly preserved.<sup>8</sup> Sections of the eyeball were also examined under the microscope. Whilst the structures are not particularly well preserved, the remains of the retina at the back and the cornea at the front could be identified and in between these, the lens.

Diseases of the eye were common in Ancient Egypt. It is thought that trachoma in particular was probably a major cause of conjunctivitis and ultimately blindness. The muscles that control eye movements are attached to the eyeball and supplied by several cranial nerves. In one of these, the oculomotor nerve, the degree of preservation was quite remarkable although the nerve fibres were disrupted in some places. The appearances were certainly suggestive of degenerative changes and possibly peripheral neuritis. This condition can be a complication of several other diseases including diabetes mellitus and vitamin deficiencies. More interestingly perhaps, it is known that poisons, particularly some heavy metals such as lead, can result in peripheral neuritis. The possible significance of this in the case of Natsef Amun will be returned to later.



**Fig. 4 Material being sucked out of the pharynx in order to introduce an endoscope**

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<sup>8</sup> A. Sandison, 'The Egyptian Mummy eye', in A.R.David (ed), Proc.Symp.Science, Egyptology (1979 and 1984), 7-9.

On the removal of the bandages on the front of the trunk, replaced loosely following the original examination, the chest wall was found to be intact. The chest cavity was first explored with an endoscope to see whether the packages containing the organs, known to have been present in 1828, had been replaced or not. Unfortunately they could not be seen.

When the bandages from the lower part of the trunk were removed, it was clear that much of the abdominal wall was missing. In the earlier examination an apparently unsutured embalming incision had been found in the left side of the abdomen. It was clear that this had been disturbed during the original examination of the abdomen and in fact during the modern investigation fragments of the abdominal wall were found in the loose packing which filled the abdomen. The material from the abdominal cavity was then removed and a more thorough search for the packages was made by working upwards beneath the ribs. Unfortunately there was no sign of them; clearly the packages that had been removed in 1828 had not been replaced. (A search for them has been made at the Leeds Museum but they have not been found). From the drawings in the original publication, it would appear from the shape of one of the packages that it contained a kidney, although usually this organ was not removed during mummification. Another package was thought to have contained the liver and the groove of the backbone which is imprinted on it suggests that this was so. The third package illustrated was believed to encapsulate the heart, although like the kidneys this was not normally removed during mummification. Unfortunately, as these packages were not available for histology, it is impossible to be sure what they contained or to identify any disease that might have been present in the organs.

A further observation made during the present examination was that behind the loose packing in the chest there was some powdery material which to the naked eye looked rather like cement. This was not commented upon in the 1828 publication but I have no doubt that it was there since it appears to consist largely of natron, a naturally occurring mixture of salts used in mummification. Radiologically, the material was opaque and appears to have been semi-solid when introduced, as the x-rays showed a horizontal fluid level, indicating that it had set hard while Natsef Amun was lying on his back.

When the bandages had been removed from the front of the pelvis and groins, the genital organs could not be recognised. However, a microscopic examination was made of some irregular material which appeared to be part of the scrotum. Histologically this consisted of skin, subcutaneous tissue and muscle and within these structures there were several filarial worms. The adult filarial worms are found in the lymphatic channels of the body and are viviparous. The larvae (known as microfilaria) circulate in the blood particularly at night, reaching maximum numbers about midnight. These forms are not able to develop further until they are ingested in blood drawn by a mosquito. They then develop in the gut of the mosquito and after about ten days reach the mouth parts. Infection of the human victim occurs when the mosquito next sucks blood. The worms are then able to develop into the adults found in the lymphatics. In filariasis the adult worm tends to block the lymphatic channels which results in fluid retention in the parts drained by the lymphatics. Those in the groin tend to be most commonly affected and the resultant swelling of the legs may be gross. Swelling of the scrotum may also occur and reach such enormous proportions that the sufferer has to support the scrotum in a wheel-

barrow which he is obliged to push along in front of him. It is not possible to say just how severe the changes were in the case of Natsef Amun since as with oedema of the tongue the accumulation of fluid would be obscured by mummification. However, it is interesting to note that the skin on Natsef Amun's feet was separated from the underlying tissue, and this could well be due to fluid which had been absorbed during mummification.

There do not appear to be any previous reports of the filarial worm or the disease it produces being found in Egyptian mummies but in view of the striking appearance of the disease, a search was made for tomb paintings which might represent this condition. Whilst the Ancient Egyptians did not commonly represent deformities in themselves, foreigners might be illustrated as they really were. It is interesting to find that the Queen of Punt, as depicted in Hapsetshut's Temple at Dehr el Bahri, has gross swelling of the legs and abdomen. This has been interpreted by some workers as being due to obesity and by others as dropsy; however, there is certainly a possibility that the swellings depicted in the Queen of Punt could be due to filariasis.

Other tissue from the groins contained the femoral arteries and these showed histological evidence of atheroma. Atheroma has been reported previously in Egyptian mummies and was shown by Shattock, one of the earliest workers to carry out histology on the Egyptian mummies, as being present in the aorta of the Pharaoh Meneptah, believed by some to be the Pharaoh of the Exodus.<sup>9</sup> However, the condition was probably not the scourge in Ancient Egypt that it is today. Two factors are probably responsible for this. In the first place, it is likely that the diet of the Ancient Egyptians did not contain the high levels of cholesterol and saturated fat that are present in modern foods. Moreover, atheroma is a progressive disease which tends to occur in middle life or later and most Egyptians probably did not live long enough to develop severe levels of atheroma in their arteries.

In conclusion, the investigations did not reveal why Natsef Amun had died but did suggest that he had problems with his health. He was shown radiologically to have arthritis and he certainly suffered from filariasis. Moreover, there was evidence of peripheral neuritis which can be produced by heavy metal poisoning. The Ancient Egyptians used many noxious substances for therapeutic purposes, including some heavy metals such as lead, and it may well be that the treatment of his filariasis with such substances caused him to develop peripheral neuritis. It is interesting to speculate that the peripheral neuritis in Natsef Amun is one of the first descriptions of an iatrogenic disease. Finally, he might well have had poor circulation and have suffered from intermittent claudication.

Clearly the answers to many of these questions remain speculative but the investigation of Natsef Amun was extremely worthwhile and has widened the range of diseases that have been found in Egyptian mummies. For this, the Manchester Mummy Team will always be extremely grateful to the Leeds Museum Committee and to Peter Briers, the Museum Director, who was a constant source of help and encouragement during the investigations.

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<sup>9</sup> S.G.Shattock, 'A report upon the pathological condition of the aorta of King Memeptah', Proc.Roy.Soc.Med. (Pathological Section). 2 (1909), 122-27.