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Undergraduate

The STEP between life and death:

People die.

This is a fact of life.



EMBALMING

Alvin Huang

When people do die,
there are many options
when it comes to disposing the body.

People die. This is a fact of life. When people do die, there are many options when it comes to disposing the body. Some bodies are buried, some

are cremated, some are left to rot, and some are embalmed. The latter option of temporarily preserving the body for aesthetic funeral purposes is relatively new, but body preservation is steeped in centuries of history. The practice of body preservation began with the preservation methods commonly used for mummification. The act of embalming a body primarily consists of replacing bodily fluids with embalming fluids, removing

various organs, and sealing the body. Formaldehyde is the primary

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chemical agent that is applied to the body and its function and its effects are chiefly responsible for momentary preservation of the body. However, the copious amounts of formaldehyde required

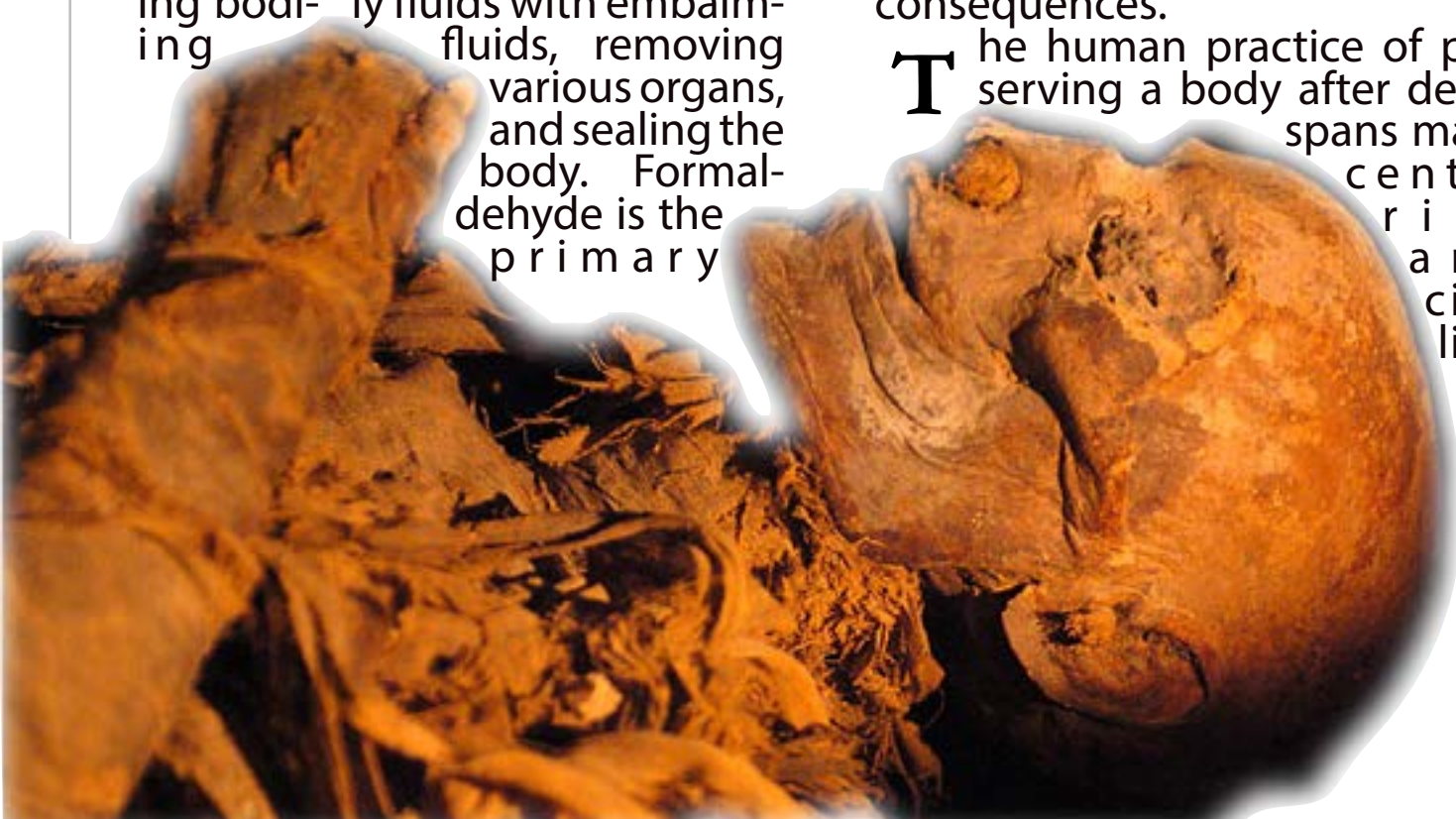
for each embalmed body brings about health concerns and risks of exposure to dangerous chemicals. Though there is no conclusive evidence for linking formaldehyde to various health issues, there are still some concerns regarding its safety in the workplace and the environment. Given the prevalence of embalming practices in our society, it is pertinent to be aware of the possible consequences.

The human practice of preserving a body after death spans many centuries and civilizations.

Mummification is perhaps the most famous form of body preservation. While the Egyptian civilization is most commonly associated with mummification, there have been many different cultures that have practiced body preservation throughout history. The ancient Egyptians practiced mummification because they believed that the person continued on to an afterlife, which required an unmarred body. Consequently, the Egyptians contrived various means to preserve the bodies of their dead. One of the simplest and earliest methods of body preservation was to wrap the body in linen, dig a hole in the desert, and place the body inside to allow the dry environment and scorching sun to do the rest; desiccation of the body is essential for natural preservation because “dehydrated bodies tend to decompose more slowly, as water is necessary for decomposition”(Quigley, 1994). Later on, more sophisticated methods were developed for nobility and aristocrats, such as removal of all bodily fluids, removal of the brain and viscera, filling the body cavities with stuffing material, desiccation

by dry natron, covering the skin with resin, and bandaging the body. The removal of the internal organs along with various bodily fluids was another method to delay decomposition because these parts were the first to undergo the decomposition process (Quigley, 1994). In other parts of the world such as 12th century Japan, Buddhist monks followed similar practices in regards to body preservation. Japanese monks would have their bodies mummified as a way of “entering into Nirvana” or becoming a “Buddha of the body” and being worshipped in their death. These mummies underwent a variety of procedures, including smoking the body to dry it, using lime powder instead of resins as varnish, no removal of the brains or viscera, and initially placing the body in a sealed chamber for three years after immediate death before any further actions are taken. Later in Renaissance Italy, the bodies of monarchs were mummified through removal of the brain and other body organs, stripping of flesh from the limbs, and the use of resins, wool, clay, lime, and other substances as for embalming. It is clear that body preservation has been present in

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many civilizations throughout time and the methods to accomplish a mummified body have been constantly changing and developing (Cockburn, 1998).

Modern embalming practices in the United States are based on contemporary medicine, physiology, and chemicals. The practice of em-

the turn of the 20th century, the physician Carl Lewis Barnes developed the extant embalming practices that are used in the contemporary United States. Barnes experimented with the use of chemicals in the human circulatory system and blood vessels. He also studied the human physiology, as a whole,



balming a body was picked up in the United States during the Civil War when the bodies of soldiers needed to be sent home. Physicians initially used arsenic as the chemical agent responsible for delaying decomposition and killing bacteria on the surface. However, embalming did not become popularized until after Abraham Lincoln was embalmed and his body placed for display around the country (Chiappelli, 2008). Around

in separate pieces, alive, and dead. Barnes sought to create a standard manner in which bodies could be made to look "alive" even after death through embalming the body. Eventually, Barnes formulated a procedure for embalming the body whereby the body's blood is replaced with embalming fluids, most commonly formaldehyde. Barnes' choice of formal-

dehyde as the ideal embalming fluid came about from his experience with using formaldehyde as a disinfectant during times of epidemics, as well as efforts to circumvent the legal prohibition against other agents such as arsenic (Podgorny, 2011).

Over time, the purposes of embalming, the process of embalming, and the materials used in embalming have changed little. The goal of embalming today remains the same as it was one hundred years ago, and that is to make the body look respectable in the final moments before being permanently removed. Unlike mummification, modern embalming is only meant to keep the body looking "alive" for a short period for the mourning process and not meant as a method for long-term preservation. Instead, modern embalming employs the use of chemicals, usually formaldehyde, to kill off bacteria in the body and delay the decomposition of the body. This is achieved through replacing the bodily fluids with embalming fluids. The entire embalming process occurs as follows: First, the body must be cleaned and disinfected of all microorganisms that may be found on the surface. Then, the neck is cut and the body is massaged to help the outflow of blood through the arteries. Next, the embalmer goes over the body and cleans, trims, and sets the body straight. Af-

terwards, the eyes and mouth are sewn shut while the vagina and/or anus are stuffed with cotton to prevent leakages. The embalmer will then inject three to four gallons of formaldehyde into the body, with the intention of pumping formaldehyde into the neck, groin, and upper arm arteries. Formaldehyde serves as the main preservative chemical by acting on the cell proteins to prevent decomposition. Additional compounds such as methyl alcohol, humectants, and anticoagulants keep the body from decaying by halting desiccation, preventing blood clots, and other factors. All of these fluids are injected intravenously via delicate syringes or powerful pumps. Immediately after the embalming fluids have been injected, the body is placed into its final position as it quickly stiffens and becomes unalterable. Once this last step is completed, the body may be placed for funeral purposes. However, it should be noted that not all bodies are successfully embalmed. The process of embalming falls prey to the same troubles that plague all work done by human hands. The most prevalent causes for this are the use of too little or too strong of an embalming fluid, careless oversight to the speed at which blood is drained, or even ignoring the visceral organs to rot. Modern embalming purposes and practices have much in common with those of one hundred

or even one thousand years ago, illustrating the similar steps taken to preserve a body (Iseron, 1994).

As alluded to earlier, there has been health concerns regarding the safety of embalming and the chemicals used in the process. Early anxieties were based on a belief that the corpse itself was a vehicle for bacterial infection: the pioneers of modern embalming practices in the late 19th century assumed that embalming a body would contain the bacteria and kill off the microorganisms responsible for disease. The practice was viewed as a public health responsibility, and was the only recourse amidst fears of epidemic contagion. However, it soon became clear that embalming a body would not prevent contraction of diseases, simply because dead bodies are not likely to spread diseases. Instead, a new caution arose concerning the use of embalming fluids – namely formaldehyde, which is the primary chemical agent used in the embalming process (Iseron, 1994).

In the past few decades, there have been concerns about the negative health effects associated with formaldehyde. There have been

claims that formaldehyde is a carcinogen and prolonged exposure to it is connected to an increase risk in nasopharyngeal cancer, leukemia, and lung cancer (Collins, 2004; McLaughlin, 1994). While experiments with lab animals have shown formaldehyde to be a carcinogen for rats, it is not considered to be a carcinogen for mice or hamsters (McLaughlin, 1994). Thus, the classification of formaldehyde as a carcinogen is not universally accepted from an exper-

“The classification of formaldehyde as a carcinogen is debatable from an experimental point-of-view.”

imental point-of-view. Multiple studies have been conducted to determine the influence of formaldehyde on human health by observing and collecting data from certain occupations that have an above-average exposure to the chemical. Several longitudinal studies have tracked the health of embalmers, doctors, workers in the metal industry, workers at industrial plants, and workers regularly exposed to plastics over the course of many years. Many of these studies conclude that the rates of cancer among these professions do not deviate significantly from the general population and refrain from making any outright claims of association, much less causation between the two variables. A study by Coggon et al. on chemical workers ex-

posed to formaldehyde concludes that “the evidence for human carcinogenicity of formaldehyde remains unconvincing [and whether] formaldehyde exposure is associated with a small increase in the risk of sino-nasal and/or nasopharyngeal cancer cannot be ruled out from the results of our study.” Furthermore, another study by Marsh et al. on metal workers concludes that “the results of our [...] study suggest that the large nasopharyngeal cancer mortality excess in the [...] cohort may not be due to formaldehyde exposure, but rather reflects the influence of external employment in the ferrous and non-ferrous metal industries of the local area that entailed possible exposures to several suspected risk factors for upper respiratory system cancer.” These studies express caution around chemicals, especially when their long-term effects on human health have yet to be thoroughly established.

In conclusion, embalming a body is a unique step taken by humans after death with the goal of preserving one’s physical appearance. The practice of body preservation goes back millennia to Egypt where bodies were mummified. However, body preservation was not geographically limited to the banks of the Nile, but also seen as prolific from one end of Europe to the other end in Asia. Various techniques were developed among various cultures, but modern American embalming practices originate from Carl Lewis Barnes. His studies on human

physiology and the circulation system and his use of formaldehyde as an embalming fluid form the basis for modern embalming methods. However, recent health concerns linking formaldehyde exposure to cancer may have consequences for the industry, but more research is required before anything can be made certain.

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