

THINK LIKE AN EGYPTIAN

THE SCIENCE OF ANCIENT EGYPT

INSPIRED BY THE EXHIBIT *TUTANKHAMUN AND THE GOLDEN AGE OF THE PHARAOS.*

Presented by  **Mellon**

					² He
	⁶ C	⁷ N	⁸ O	⁹ F	¹⁰ Ne
	¹² Si	¹⁵ P	¹⁶ S	¹⁷ Cl	¹⁸ Ar
	³² Ge	³³ As	³⁴ Se	³⁵ Br	³⁶ Kr
	⁵⁰ Sn	⁵¹ Sb	⁵² Te	⁵³ I	⁵⁴ Xe
	⁸² Pb	⁸³ Bi	⁸⁴ Po	⁸⁵ At	⁸⁶ Rn

Note to Educators & Parents

All of these activities support the National Science Education Standards. In particular, the activities meet the following objectives.

**Content Standard A:
Science as Inquiry**

Activities meet this standard when students *identify testable questions* and understand that *mathematics is essential in scientific inquiry*.

**Content Standard B:
Physical Science**

Activities meet this standard in part when students recognize the different *physical properties of compounds* and that *chemical reactions occur all around us*.

**Content Standard C:
Life Science**

Activities meet this standard in part when students learn that *most cell functions involve chemical reactions*.

**Content Standard E:
Science and Technology**

Activities meet this standard in part when students understand that *scientists in different disciplines ask different questions, use different methods of investigation, and accept different types of evidence to support their explanations*.

**Content Standard F:
Science in Personal and Social Perspective**

Activities meet this standard in part when students learn that *many diseases can be prevented, controlled, or cured and that human populations use resources in the environment in order to maintain and improve their existence*.

**Content Standard G:
History and Nature of Science**

Activities meet this standard in part when students realize that *scientists are influenced by societal, cultural, and personal beliefs and ways of viewing the world and that diverse cultures have contributed scientific knowledge and technologic inventions*.

This activity guide is provided through the generous support of **Mellon Financial Services**.

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Canopic Coffinette of Tutankhamun

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The ancient Egyptians understood a great deal about human anatomy and practiced an organized system of medicine. While they didn't fully understand the complexities of biochemistry, they made remarkable strides in developing cures for ailments.

In some ways, their understanding of how to treat disease was a result of their devotion to the afterlife. Because of their concern for preserving the body—through mummification—for eternal life, they came to know a lot about what existed inside the body. Their post-mortem practices actually helped them learn a great deal about how living systems work.

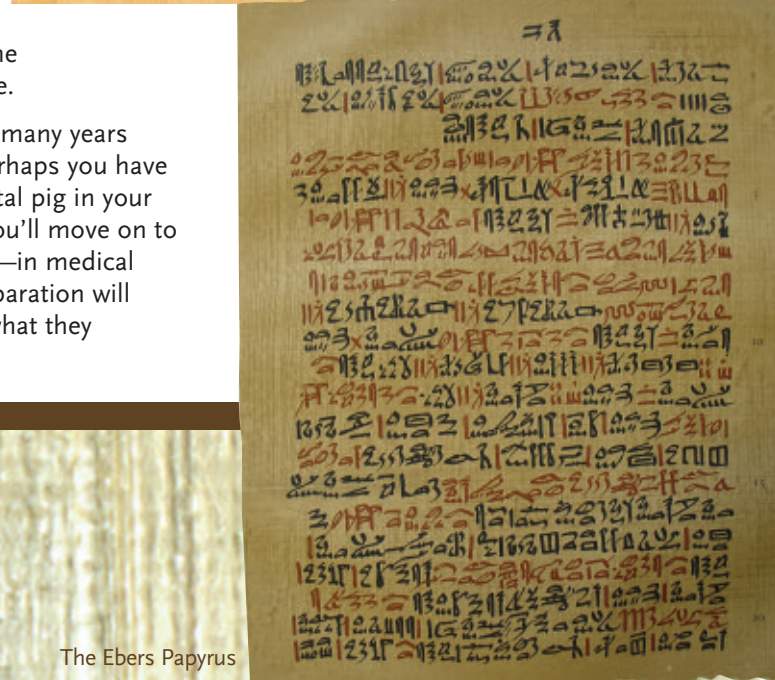
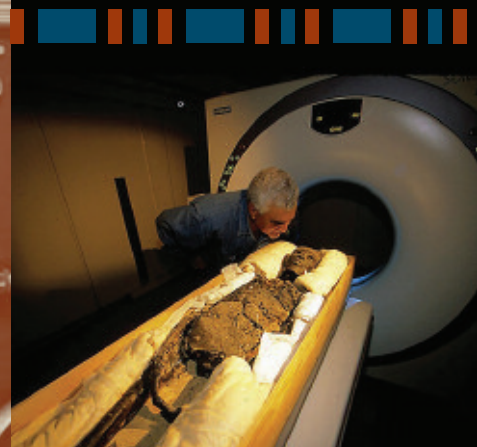
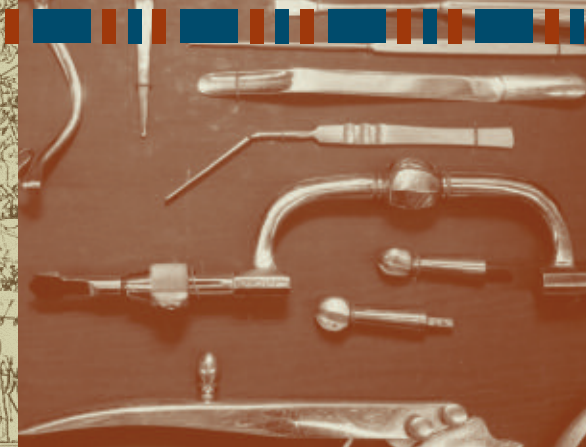
Today, autopsies are usually conducted when a person dies unexpectedly or through suspicious circumstances. In ancient Egypt, however, all bodies were prepared for mummification, so the removal of internal organs became a routine post-mortem practice.

If you decide to pursue a career in medicine today, you will spend many years studying living organisms through post-mortem examinations. Perhaps you have already begun this journey by dissecting an earthworm, frog, or fetal pig in your high school science laboratory. As you continue your education, you'll move on to dissections of larger organisms with more complex systems until—in medical school—you will likely encounter a human cadaver. All of this preparation will enable you to help save lives, just as the ancient Egyptians used what they learned through their post-mortem practices to treat the living.

THE EBERS PAPYRUS

In 1872, a German man named Georg Ebers purchased a 110-page scroll of papyrus in a market in Luxor, Egypt. That papyrus—which came to be known as the Ebers Papyrus—contained a thorough explanation of medical practices in ancient Egypt as recorded in 1552 BC. Now housed in a library at the University of Leipzig in Germany, the Ebers Papyrus is the oldest and most thorough record of medical practice ever discovered, helping unlock the secrets of daily life among the ancient Egyptians.

The papyrus contains chapters on intestinal disease, ophthalmology, dermatology, gynecology, obstetrics, dentistry, and the surgical treatment of abscesses, tumors, fractures, and burns. It also includes a surprisingly accurate description of the circulatory system, noting the existence of blood vessels throughout the body and the heart's function as a center of the blood supply. The papyrus also contains a short section on psychiatry, describing a condition of severe despondency that is equivalent to our modern definition of depression.



The Ebers Papyrus

The next time you visit your doctor's office, look around for the Physician's Desk Reference. Today, physicians rely on a copy of this thick book to "look up" known treatments for symptoms. In many ways, the Ebers Papyrus was used the same way. In the Papyrus, readers find lengthy lists of recommended treatments for ailments. Many of these treatments involve common plants, herbs, and ingredients still in use today. The table below shows some of the suggested remedies for Ancient Egyptian illnesses. Do any of these look familiar?

	INGREDIENT						
	USED TO TREAT	Sore Throats	Digestive problems	Burns Skin Rashes	Bad Breath	Headaches	Asthma

THE EDWIN SMITH SURGICAL PAPYRUS

If the treatments suggested in the Ebers Papyrus were insufficient, the Edwin Smith Papyrus might help—it described surgical procedures!

Like the Ebers Papyrus, the surgical papyrus was also purchased at a market in the town of Luxor in Egypt. Edwin Smith was an American living in Egypt at the time. He had a fascination with Egyptology and so became a collector of ancient artifacts. He found the surgical papyrus in 1862, not knowing how important it would become in the understanding of Ancient Egyptian medical practice. Today, the Papyrus is in the collection of the New York Historical Society.

Scholars believe that Imhotep is the original author, although it appears that at least three different authors contributed to the Papyrus which takes a "case study" approach to the subject of surgical treatment, using 48 battlefield injuries as examples of how to treat traumatic wounds.

Imhotep was a very important person in ancient Egypt. Today, he is considered to be the first physician known by name in recorded history. Besides developing medical practices, he also influenced Egyptian architecture and design.

The 48 cases are arranged systematically, beginning at the top with injuries of the head and then moving to the spine and the thorax (chest area). Each case offers a title, examination, diagnosis, and treatment. Of the total 48 cases, 27 involve head trauma, with 4 deep scalp wounds, and 11 skull fractures. The following two examples suggest treatments for serious wounds.

Case Two: Instructions concerning a gaping wound in his head, penetrating to the bone.

Examination: If thou examinest a man having a gaping wound in his head, penetrating to the bone, thou shouldst lay thy hand upon it (and) thou shouldst palpate his wound. If thou findest his skull uninjured, not having a perforation in it...

Diagnosis: Thou shouldst say regarding him: "One having a gaping wound in his head. An ailment which I will treat."

Treatment: Thou shouldst bind fresh meat upon it the first day; thou shouldst apply for him two strips of linen, and treat afterward with grease, honey, (and) lint every day until he recovers.

Case Twelve: Instructions concerning a break in the chamber of his nose.

Examination: If thou examinest a man having a break in the chamber of his nose, (and) thou findest his nose bent, while his face is disfigured, (and) the swelling which is over it is protruding.

Diagnosis: Thou shouldst say concerning him: "One having a break in the chamber of his nose. An ailment which I will treat."

Treatment: Thou shouldst force it to fall in, so that it lies in its place, (and) clean out the interior of both his nostrils with two swabs of linen until every worm of blood which coagulates inside his two nostrils comes forth. Now afterwards thou shouldst take two plugs of linen saturated with grease and put them into his two nostrils. Thou shouldst place two stiff rolls of linen, bound on. Thou shouldst treat him afterwards with grease, honey, (and) lint every day until he recovers.

What do you wonder?

Based on the treatments excerpted from the Ebers Papyrus and the Edwin Smith Papyrus, what three things do you wonder about ancient Egyptian medicine? Try to compose good research questions that include testable hypotheses.

1. _____
2. _____
3. _____



WHAT IS A MUMMY?

A mummy is a corpse whose skin and dried flesh have been preserved by either intentional or accidental exposure to chemicals, extreme cold, very low humidity, or airlessness. Ancient Egyptians used chemicals—natural salts—to dry their corpses. Basically, when all moisture is removed from a corpse, it becomes a mummy. The Egyptians used natron—a naturally-occurring *desiccant*. A desiccant is a substance that has a high affinity for water and is used as a drying agent.

The earliest known “mummy” dates back to approximately 3300 BC. This mummy is at the British Museum in London, England and has been given the nickname of “Ginger” because of its red hair. “Ginger” was found buried beneath the hot, dry desert sand which preserved the body.

Although mummification existed in other cultures, eternal life was the main focus of ancient Egyptian religion. In order to prepare for eternal life, the body needed to be preserved so that the person’s soul—called “ba” by Egyptians—would always have a place to reside after death. At first, the Egyptians tried to preserve the entire body. Over time, though, they realized that they needed to remove the internal organs. They crafted special canopic jars to hold the organs. Then, embalmers used natural salts to remove all moisture from the body so that it is difficult for bacteria to thrive inside it and cause decay. Once all moisture was removed and the body fully dried, the mummies were anointed with oils and perfumes to prepare them for their journey to the afterlife.

Since mummification was a process associated with religious belief in eternal life, the embalmers in ancient Egypt were actually specially-trained priests. They knew how to work with salts and which prayers and rites were associated with each step in the process.

Canopic jars to hold the internal organs during the mummification process



What is Natron?

Natron is a white/colorless salt found in the Earth in various locations around the world, including Egypt. The Egyptians called it “natron” because they found vast supplies of it in the Natron Valley’s salt lakes. These lakes were linked to the Nile River via underground channels, but they were dry most of the year.

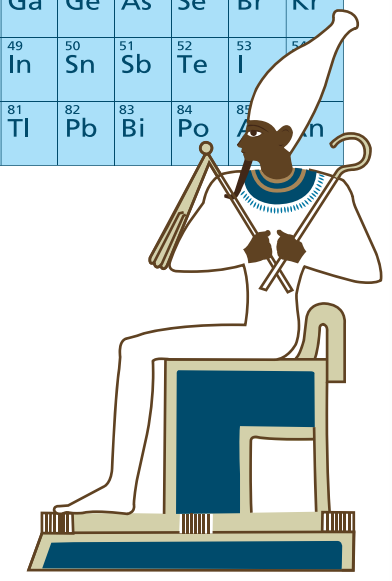
Natron is a hydrated sodium carbonate mineral with the formula $\text{Na}_2(\text{CO}_3) \cdot 10(\text{H}_2\text{O})$. Notice the elements in the formula:

Hydrogen Sodium Carbon Oxygen

1 H	11 Na	6 C	8 O	2 He													
3 Li	4 Be	$\text{Na}_2(\text{CO}_3) \cdot 10(\text{H}_2\text{O})$		5 B	6 C	7 N	8 O	9 F	10 Ne								
11 Na	12 Mg			13 Al	14 Si	15 P	16 S	17 Cl	18 Ar								
19 K	20 Ca	21 Sc	22 Ti	23 V	24 Cr	25 Mn	26 Fe	27 Co	28 Ni	29 Cu	30 Zn	31 Ga	32 Ge	33 As	34 Se	35 Br	36 Kr
37 Rb	38 Sr	39 Y	40 Zr	41 Nb	42 Mo	43 Tc	44 Ru	45 Rh	46 Pd	47 Ag	48 Cd	49 In	50 Sn	51 Sb	52 Te	53 I	54 Xe
55 Cs	56 Ba		72 Hf	73 Ta	74 W	75 Re	76 Os	77 Ir	78 Pt	79 Au	80 Hg	81 Tl	82 Pb	83 Bi	84 Po	85 At	86 Rn
87 Fr	88 Ra		104 Rf	105 Db	106 Sg	107 Bh	108 Hs	109 Mt	110 Uun								

Molecular Weight = 286.14 gm

Sodium	16.07 %	Na	21.66 %	Na ₂ O
Hydrogen	7.05 %	H	62.96 %	H ₂ O
Carbon	4.20 %	C	15.38 %	CO ₂
Oxygen	<u>72.69 %</u>	O		
	100.00 %		100.00 % = TOTAL OXIDE	



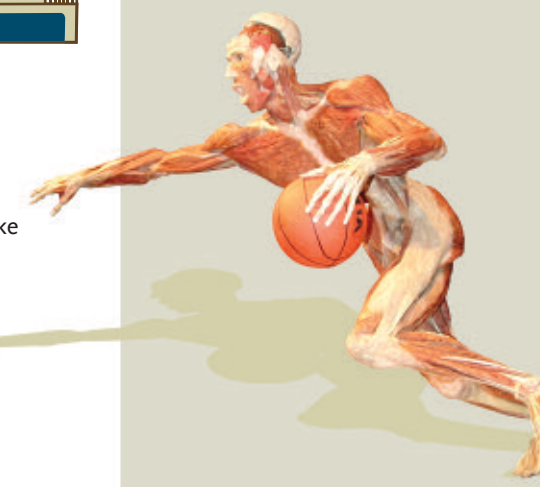
MODERN MUMMIES

Have you heard of plastination?

Gunther von Hagens invented the process of plastination while working at the anatomical institute of the University of Heidelberg in 1978. Like in other mummification processes, the water and moisture is removed from the body. In plastination, the fluids are replaced with plastics, taking the space of fluids so that the body retains much of its original form.

The result is a mummy that can be touched, does not smell or decay, and even can continue to resemble the living being—both in appearance and at the cellular level.

If you visited the “BodyWorlds” exhibit at The Franklin Institute, you’ve seen these modern mummies!

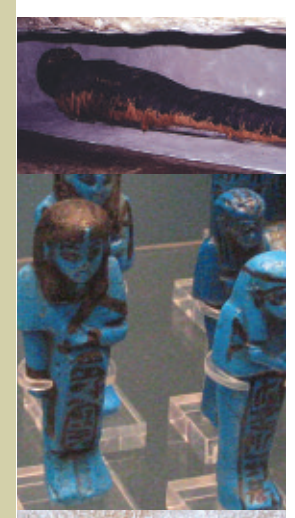


Let’s Make an Apple Mummy!

1. Cut the apple in half. Then, cut each half in half again so that you have four quarters. Select the two quarters that appear to be the closest in size. (You won’t need the other two quarters, so you can eat them.)
2. Put one quarter in each of your two plastic cups. Use your laboratory scale to weigh each of the two cups. Record your data.
3. Prepare the desiccant mixture. Fill the measuring cup to the one-third cup level with baking soda. Then, use the salt to continue filling the cup up to the two-thirds level. Use the spoon to gently mix the baking soda and salt together in the cup.
4. Pour the mixture into one of the two plastic cups, covering the apple quarter. Make sure the apple is completely buried.
5. The apple in the other cup is your control sample. Do nothing to it. Leave it exposed to air.
6. Place the two cups side-by-side somewhere dry and away from direct sunlight. (A shelf in a closet or cabinet works well.)
7. Wait seven days. Carefully uncover your buried apple by pouring the baking soda/salt mixture out. Compare the two apples. Weigh the two cups again and compare your data. (Warning: do not eat either apple! Discard both after you finish comparing them.)

TRY THIS!

- You’ll need:**
- Small apple
 - Two plastic cups (about 10 ounce size)
 - One box of baking soda
 - One box of table salt
 - One-cup measuring cup
 - Knife
 - Spoon
 - Laboratory Scale



When natron comes in contact with moist materials, it acts as a drying agent, drawing the moisture out of the other material and into its own molecules.

As a mineral, natron had many other uses in ancient Egypt besides for mummification. Artists mixed Natron with other minerals and oils to make the color known as “Egyptian Blue” that appears in so many recovered artifacts. Natron was also used to make glass and ceramics and as a soldering agent for binding precious metals (especially gold) together. Mixed with oil, natron became a kind of soap. Mixed into a paste, natron was used as a toothpaste and mouthwash. When mixed with salt, natron could be used to preserve fish and meat for future meals. In many ways, natron was a vital ingredient of civilization in ancient Egypt.

Natron is still mined and used today. One surprising use is in the preparation of Bavarian Pretzels! Dough is dipped in a natron solution before baking to give the pretzels their distinctive flavor and brown color.

