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create

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Letter from the Editors

Dear Readers of UnEarthed,

On behalf of UnEarthed's Executive Board and our student-led team of writers, editors, and designers, we welcome you to our tenth issue of UnEarthed. It is our pleasure to present to you, CREATE! In this 28-page magazine, you can read about ideas spanning the subjects of art, history, and technology that our team picked for you. We hope you take away new ideas from these pages and use this as a stepping stone to all your future dreams and ambitions.

Creativity is defined as a process that leads to new and useful ideas, products, or expressions. Creativity is all around us every day. We see it, feel it, taste it, and live it. Nothing is too small or too big to be creative. In this magazine, you will find examples of creative ideas spanning from the invention of Wi-Fi to the cloning of Dolly the sheep. We show that there is not only one-way creative ideas are formed but instead multiple ways ranging from working hard in a makerspace to discovering something by pure accident. One article even dives into how creativity is made possible by our own brains! We hope you will be inspired by articles like the history of basketball or the science behind making rock candy. Can you think of the last time you had a creative idea?

Near the end of this issue, you will find two full pages of puzzles and games that you can share with your friends and family. With a word search, brainstorming template, and a classic puzzle, we hope you have some fun and learn something new. We even included a signature page for you to share with your friends and fellow UnEarthed readers. Maybe this interactive page will become the beginning of a rap song, the blueprint for a clever invention, or the recipe for a crazy food combination.

We had a wonderful time creating this magazine over the past few months. New editions of UnEarthed are published twice a year and shared in classrooms across Philadelphia. Each edition is built upon an exciting big concept that is different for each and every issue. In addition to print magazines like Create, you can also find digital-only articles, fun quizzes, and informative videos on our website. Visit www.uneearthedpenn.com to start exploring today!

As a magazine, we strive to improve our next issue based on feedback and suggestions from readers like you. We look forward to receiving anything, like the comments you have on our interactive pages or requests for future article ideas. Please feel free to fill out the Suggestion Box on our website (<https://www.uneearthedpenn.com/suggestion-box>) with your thoughts.

We believe that the ideas in this issue will give you tools to expand your imagination. It is our dream that Create reminds you that there are endless possibilities out there once you put on your thinking cap. We hope you enjoy this new edition of UnEarthed, and we wish you a wonderful spring and summer!

Emily Sheng
EDITOR IN CHIEF

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MANAGING EDITOR

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The Creation of CLONES in Science

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Design by JHAUGHANESSY MORRIS

Have you ever wondered how dinosaurs were recreated in Jurassic Park? Or how Jedi clones were created in Star Wars? The idea of cloning often comes up in popular culture, and it has been framed as a concept from fictional stories that defy reality. However, cloning is actually a real practice that is being used by scientists and lab researchers today.

Cloning is the process of creating identical copies of an organism, or living thing. In nature, clones can occur as a part of some reproductive events. For example, some microorganisms like bacteria produce “identical daughter cells” from a single “parent cell” by way of cell division. The DNA in the parent cell is replicated, or copied, prior to being passed onto the daughter cells, creating “natural clones” with identical genetic makeup. In more complex organisms like mammals, cloning can occur naturally through the birth of identical twins. This occurs when the fertilized egg splits, so the resulting twins possess almost identical genetic makeup.

In today’s laboratories, researchers have been able to clone cells and even entire organisms. There are three types of cloning that humans can perform: gene cloning, reproductive cloning, and therapeutic cloning. Let’s delve into each of these techniques!

Gene cloning is the process of creating identical copies of DNA. DNA contains the unique genetic information that makes organisms different from one another, similar to blueprints for a house. To clone DNA, scientists can take “foreign genetic material,” or DNA from the cell of interest, such as a human cell, and transfer it to a “vector.” A vector is usually a simple organism like bacteria or yeast that reproduces rapidly, making it easy to multiply a sequence of DNA in a genome over time since DNA replication must occur prior to reproduction.

Reproductive cloning is much more difficult and time-consuming than gene cloning. Through this technique, an entire living organism (including animals) can be cloned by first removing a somatic cell from the individual of interest. Somatic cells are all body cells not directly involved in reproduction, such as skin cells. These extracted somatic cells can then be implanted into an empty oocyte, or an egg cell that had all of its own DNA removed. The egg can then develop in the test tube, before being transferred to the womb of an adult female. When the animal is born, it has DNA to the animal that donated the somatic cell to the egg, thus being deemed a clone.

The most famous instance of reproductive cloning was the case of Dolly the sheep in

1996. A somatic cell was taken from Dolly’s udder and then transplanted into an egg cell. The egg was transplanted from the test tube to another sheep’s womb where it would develop until birth. Dolly’s clone was born on July 5th, 1996 with the same genetic makeup as Dolly! This was an important event for the practice of cloning because it marks the first time a mammal was cloned from an adult somatic cell.

The final type of cloning is known as therapeutic cloning. This involves the cloning of an embryo, or an unborn organism going through development, in order to use its stem cells to treat diseases in another organism. Stem cells are cells in the body that have yet to differentiate, or specialize in a specific task. These cells can therefore be used to replace damaged tissues containing cells that are already specialized by growing the healthy cloned tissues in a controlled laboratory setting. This form of cloning comes with downsides in disease treatment, as stem cells have similar rates of cell growth as cancer cells. Therefore, scientists need to find how stem cells relate to cancer cells, in order to prevent cancer in patients needing therapeutic cloning.

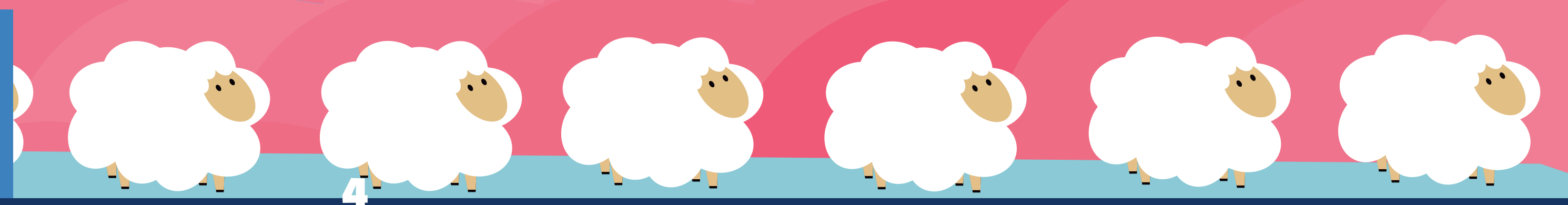
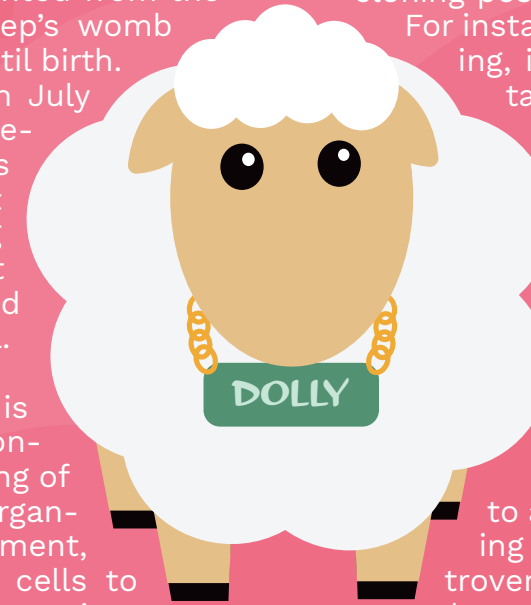
Cloning seems super exciting for the future of science, right? However, it is crucial to remember that all good things in science come with ethical issues. Ethical issues arise because the morals of a given practice are brought into question. In other words, what can go wrong with cloning?

While gene cloning is widely accepted today, reproductive and therapeutic cloning pose some ethical questions. For instance, in reproductive cloning, it can be argued that this task tampers with the natural course of nature. This technique can be used to bring back extinct species that could negatively affect the current state of ecosystems. On the other hand, with therapeutic cloning, treating an existing human’s disease would require harm to a human embryo developing in a test tube. This is controversial to some, who claim it destroys one human life to save another.

In all, scientists have been able to perform what was thought to be impossible through many different cloning techniques; however, there are still some unanswered questions in this field. For instance, unlike other animals, human cloning has yet to be done, fearing possible defects that could arise in the clone’s genes. On another note, for therapeutic cloning, more research must be performed to reduce risks of cancer when therapeutic cloning must be used on patients.

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SOUR MILK makes the BEST CHEESE

Our bowl of cereal needs a hefty pour of milk...But, as the milk gets poured in, we discover that it's chunky and smells sour—how gross! Our cereal is ruined, but curdled milk doesn't always have to be bad. Sometimes, curdled milk is exactly what we want. If you like cheese, then you definitely need curdled milk!

The cheese making process starts by collecting milk. In most cases, milk is collected from a dairy cow, but this isn't always the case. Milk can be collected from goats, sheep, horses, camels, and even water buffalo. Any milk is a good milk to make cheese! After the milk is collected, it's pasteurized or heated at high temperatures to make sure that no dangerous bacteria stays in the milk and makes people sick.

Next, a starter culture or starter is added to the milk. The starter is a special mix of good bacteria and yeast that eats all the sugar inside the milk. Depending on the starter mixture, the cheese can gain a different flavor or texture. Some cheeses are stinkier than others because of the kind of bacteria added at the start. The bacteria *Brevibacterium linens* smells like sweaty, stinky feet and it's also what gives Limburger cheese its funky aroma. Luckily, most cheese don't taste as bad as they smell. And if you aren't convinced, plug your nose and take a bite!

After this, a largely unknown but incredibly important ingredient is added: rennet. It's the secret to making curdled milk on purpose! Today rennet can be made in a lab, but thousands of years ago, liquid rennet was taken from the stomachs of calves and added to make cheese. In countries like India, where cows are sacred, liquid from fruit trees was used instead.

Rennet helps the milk separate into two parts also known as curdling the milk. The first part is the curd or clump and the second part is the liquid or whey. The whey is then drained away so that only the clumps remain.

Now, the clumps are heated up and salted.

Through this process they release even more whey which has to be drained off. Finally, the remaining curds are pressed into molds and left to age. Eventually, that cheese may end up in your next lunch sandwich—keep your fingers crossed that it's not a super stinky cheese!

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How to Make Rock Candy

Writing by MIRANDA MENG | Design by XUE JIANG
Editing by TED DAVIS & JOYCE LEE

Do you have sugar and water at home (and maybe a little bit of patience)? Then you've got what it takes to make rock candy! But first, let's understand how this sweet treat comes about.

If you try mixing sugar in a cup of water, you'll notice the sugar crystals break down, or "dissolve"—when this happens, you can no longer see the sugar pieces, and the water looks clear. However, if you keep adding sugar and mixing, you will notice that at some point, the sugar stops dissolving! The water cannot hold any more sugar, so additional pieces simply fall to the bottom. When you reach this point, this is called a "saturated" mixture.

However, it turns out you can stretch the limits of this mixture even further: if you heat up the water, you can dissolve even more sugar in it. Now, you've created a "supersaturated" mixture. A "supersaturated" mixture looks clear even after more sugar has dissolved in it, compared to the amount of sugar that can dissolve in room temperature water. This extra sugar in the supersaturated mixture is what lets you make rock candy. When this supersaturated mixture cools down slowly, without being shaken, it forms crystals. Try it yourself with these steps (all needed items are in bold!):

1. Heat **2 cups water** in a **saucepan** until boiling.
2. Completely dissolve **4 cups sugar** in the water, and keep stirring it with a **wooden spoon** until the mixture is clear.
3. Carefully pour the mixture into a small **glass jar**. Cover the top with **wax paper**.
4. Get a piece of **cotton string** that is a little longer than half of the jar's height.
5. Tie a **small weight (like a washer)** to one end of the string. Tie the other end to the middle of a **pencil**.
6. Dip the string in the sugar mixture in the jar. Then, remove it, and lay it straight on wax paper for 1-2 days. (This will let the string dry, which makes it easier for the rock candy to stick onto the string later.)
7. Put the pencil over the jar so the end of the string dips into the mixture. Keep this at room temperature, and do not touch the jar or string for a few days.
8. By a week, there should be crystals on the string for you to eat! (Don't try putting the mixture in the fridge to speed things up, though! If it cools too quickly, or if it is shaken, the crystals that are created will be very small and will not stick together.)

Now, you'll have a sweet treat! With the extra sugar that can dissolve in boiling water, and the crystals that built up after you left the mixture alone for a few days, this candy was able to form for you to enjoy.

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Philly Mural Arts



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Design by **EJUN HONG**

What is the Philly Mural Arts Project?

Philadelphia is a city with many nicknames: Philly, The City of Brotherly Love, The Birthplace of America, The City that Loves You Back, The City of Neighborhoods, the Quaker City. Did you know that it is also known as the “Mural Capital of the World”?

For good reason too! Philadelphia has the most murals and public art in the entire Country! Today, the number of murals in Philly is somewhere over 4,000. The effort to create these pieces of work began in 1984 when artist Jane Golden was hired as part of a project with the Philadelphia Anti-Graffiti Network. Creating the Mural Project was Philly’s plan to address the graffiti problem.

Jane Golden knew that graffiti art had a powerful history in community and political movements. In ancient Greece, people wrote messages to one another on brick walls. In the 1780s, French citizens wrote on buildings, statues, and high-class art to protest the unjust class system, which had a negative view toward the so-called commoners.

In the 1960s, a boy from Philadelphia began writing his nickname ‘Cornbread’ around the city. Cornbread, or Darryl McCray, pioneered tagging, a practice where artists write their names on public surfaces. Soon enough, Cornbread was an icon in Philadelphia– he even wrote his name on the side of an elephant at the Philadelphia Zoo and on an airplane belonging to a very popular pop band during that time, called the Jackson 5! In 1984, he was one of the artists who Jane Golden worked with to begin the mural project. Artists like Darryl McCray were able to create art for and by the Philadelphia Community.

The Mural Arts project has created around 4,000 pieces of artwork in public places. For all of these pieces, the artists came together from the Philadelphia community and around the world. Their initiatives are clear. They want to empower individuals, neighborhoods, and community groups by starting conversations that bring people together, creating

programs for certain people, as well as provide youth education and restorative justice

The Murals

The project, Mural Arts creates somewhere between 50-100 works of art each year. The very first mural, in 1984, was titled ‘Life in the City.’ This mural covers both sides of the 636 feet long Spring Garden Street Bridge, a bridge that connects West Philly to Center City. This project took about a month to complete with almost 100 different young artists participating. From there, the program became the nation’s largest public art program.

In 1990, Kent Twitchell joined the project to paint the Dr. J, Julius Erving mural, which is located at 1219 Ridge Avenue. This mural allowed for the art to show something that was important to the community. Another mural, Common Threads by Meg Saligman was painted in 1997 and is about eight stories high. To celebrate the 100th anniversary of the Lincoln Financial Group, Mural Arts commissioned a 10,99 foot mural in 2005 that showed the legacy of Abraham Lincoln. This mural was created by Josh Sarantitis and Eric Okdeh. Some of their paintings went on to win awards. In 2012, Mural Arts hired Hass and Hahn, famous Dutch artists whose four-blocklong painting won a public award from Americans for the Arts’ Public Art Network. These are just a handful of examples of beautiful pieces the Mural Art project made possible.

Who are the artists and how can you visit these paintings?

Mural Arts brings together many different artists to work together and create magnificent pieces of art. They’re made up of all kinds of artists with different artistic skills and motivate people in the city to beautify the town further. Each piece is unique in its own way and provides the community with pieces of motivation and inspiration as they walk past them everyday. They are scattered all over Philly but you can catch a tour to see a few of them in certain areas of the city!

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Accidental Inventions

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Editing by ANOUSHKA AMBAVANEKAR & JOYCE LEE

Despite our best efforts, sometimes our plans just don't work out – but that doesn't always have to be a bad thing. In fact, sometimes our mistakes could lead us in an entirely new, or even better direction. When these “happy accidents” happen, we call it serendipity. Here are 4 cool discoveries that you may not know were discovered by accident!

1. Penicillin

Antibiotics are important medication for treating bacterial infections. The world's first antibiotic was a chance discovery that we should all be grateful for. Penicillin was discovered by the microbiologist and physician Alexander Fleming. One evening, he left out plates of bacteria and when he returned he saw that a mold had grown on the plates and had killed the surrounding bacteria. This mold is what modern penicillin, an important type of antibiotic, is derived from. Penicillin's discovery revolutionized the world of medicine and greatly reduced the number of deaths from infections of highly treatable injuries.

2. Implantable Pacemaker

In 1956, an assistant engineering professor, Wilson Greatbatch, was trying to create a device to record the sound of the heart. While doing so, he used the wrong transistor (a device that controls the flow of electricity) and instead created a device that sends out electrical pulses, like the heart. He presented this device to the surgeon William Chardack and after some changes, they successfully controlled a dog's heart-beat with their device, laying the foundations for the modern pacemaker which is used to treat several types of heart diseases.



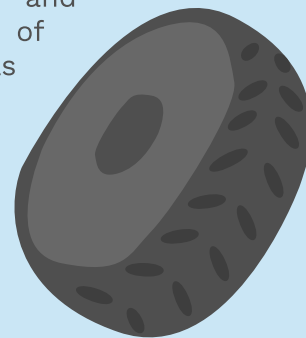
3. Post-It Notes

The invention of post-it notes was likely the last thing scientist Dr. Spencer Silver had in mind while researching strong adhesives (glue). He instead discovered a very weak adhesive which he thought was useless. This was until another scientist, Arthur Fry, came to him with the idea of bookmarks that stick to pages without damaging them, and together their brainchild eventually became the post-it notes we know today.



4. Vulcanized Rubber

Rubber in its natural form cannot withstand changes in temperature and thus, rubber products were ruined by changes in weather. This unreliability of natural rubber had led to the decline in its use. However, in 1839, chemist and engineer Charles Goodyear accidentally dropped some rubber on a hot stove with some sulfur, which led to it hardening and becoming more durable and waterproof. This process of hardening rubber is known as vulcanization and is used very often today, for example in the sole of your shoes, erasers and rubber hoses.

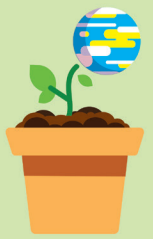


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Hybrid Fruits



Writing by HEEJOON SHIN | Editing by GRACE QIAN & TED DAVIS | Design by CHEAVLAY PHAT

It is now possible to play around with food - not physically, but chemically. With the modern technology and knowledge that scientists have, fruits can have their deoxyribonucleic acid (DNA) altered to make them much juicier or exhibit a deeper, saturated color. Through several experiments and observations, an apple could have a purple color, or grapes could exhibit a sweeter flavor. Even oranges could have a lime flavor, which actually exists as Rangpur fruits.

The Rangpur fruit is one of the many examples of hybrid fruits, a fruit that is genetically manipulated through breeding. Similar to breeding dogs for wanting specific traits, scientists have engineered fruits to exhibit certain colors, taste, or even shape. Through the breeding process, parents with favorable traits are chosen to create offspring that embodies these traits. In a simple example regarding tomatoes, scientists have bred them to look more red for selling purposes, even though many naturally look more green!

Another example consists of strawberries called pineberries, which are the ‘inside out’ versions of regular strawberries; in other words, pineberries have a white coating with red seeds that overall taste like pineapples. These strawberries are the hybrid of *Fragaria chiloensis* (Chilean strawberry) and *Fragaria virginiana* (Virginia strawberry) which gives pineberries their look and taste. Another hybrid fruit includes a plumcot, a hybrid of a plum and apricot. The result of this fusion? A much sweeter and richer juice! There's also tayberries that are a hybrid of a blackberry and raspberry; it looks like a very elongated blackberry that looks reddish. The fruit also results in a strong tart flavor that goes very well with pies, jams, and even cookies. Meanwhile, there's an ugly fruit (a hybrid of an orange and grapefruit). While it looks like a grumpy orange with lots of wrinkles, it tastes quite tangy, sweet, and bitter.

Fruits can also be genetically modified to change certain traits. Here, scientists modify fruits by directly manipulating the plant's genomes, or the DNA of the plant. These are called GMOs or genetically modified organisms which result in fascinating properties. For instance, scientists have engineered fruits so that they are more resilient to diseases. This includes engineered bananas that are more resilient to Panama disease, a disease that threatens the banana industry. Additionally, scientists have engineered Arctic apples, which elongates apple's shelf life by turning them brown much more slowly after cutting them. Finally, even tomatoes were genetically modified to look redder and plumper.

Hybrids and genetically modified plants pave the way for new and improved fruits that would tremendously improve the food and agriculture industry. It is only a matter of time before modern technology catches up and mass produces these fruits so that they are widely accessible to the general public.

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DISCOVERING DINOSAURS

Writing by JULIA VAN LARE

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Dinosaurs – you may know them as prehistoric monsters with big teeth, scaly skin, and in the case of the t. Rex, tiny arms. But, if they all died out 65 million years ago, how do we know what they look like? Are they really scaly, tiny-armed monsters?

To figure out the answer to this question, we must first reconstruct dinosaur bones. If you've been to a science museum, you've probably seen dinosaur fossils before. Fossils are dead plants or animals that have been preserved by the minerals in solid material known as sediment. Sediment can be dirt, sand, or even lava from a volcano. In the case of dinosaurs, these fossils continue to be uncovered to this day.

Scientists must then puzzle out how the dinosaurs' bones fit together. This bone structure is easy to figure out when the skeleton is intact. Most often, though, bones are separated over time. In this case, scientists compare the structure of animals that are still alive, like birds, to extinct animals and reconstruct the bones. This method is how we know that dinosaur tails stick straight back – before 1970, it was thought that they dragged on the ground.

Now that we have the bone structure figured out, we have to tackle the body. Scientists can piece together how muscular a dinosaur is based on its characteristics. For example, a t. Rex was a meat eater, which means it likely would have needed a strong jaw to chew and digest its food. Also, just like when reconstructing bones, we can use living animals to figure out the orientation of the dinosaur body parts.

Take the tiny t. Rex arms, for example. There is evidence that birds developed from dinosaurs, so scientists have used turkey arms to figure out which way the t. Rex's arms are positioned. When you think of a t. Rex, do you think of its palms as facing downwards, like it's playing the piano? Well, a study from 2018 suggests that the t. Rex's palms faced each other, almost in a clapping position. In other words, many scientists think that the t. Rex "was a clapper, not a slapper."

We know what the bone structure and the body of the dinosaur looks like – now, we have to think about the skin of the dinosaur. How do we know that the skin is scaly? Paleontologists have found several fossils that are preserved enough to see scaly skin. This is the case of the two fossils called the "dueling dinosaurs," – two dinosaurs who died fighting each other, one a Triceratops and one an unidentified meat eater – that were found in Montana in 2006.

We know they have scales, but to figure out the color of the scales, we have to look at the environment in which the dinosaurs lived. The t. Rex lived in a green, lush area. As a predator, the t. Rex would have benefited from blending into the trees and bushes that surrounded it – it's for this reason many scientists believe that the t. Rex was brown or green, though we do not know for sure.

So now you have your picture of a t. Rex: tiny, clapping hands and green, reptilian scales. You're missing one thing, though – feathers.

Scientists now believe that several kinds of dinosaurs had feathers. For one thing, feathers have been found among some fossils. For another, such as in the case of the t. Rex, studying close relatives of certain dinosaurs has led scientists to believe the dinosaurs have feathers. However, for long necked dinosaurs, like the Brachiosaurus, it's more likely the animal was scaled without feathers.

For many, picturing the famous t. Rex with feathers is weird and unfamiliar, and yet, scientists are fairly confident that was how they looked. Some questions – such as color and the movement of arms and legs – are still a mystery to us all. But with fossils still underground and not yet discovered, we may still learn more about what dinosaurs looked like.

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Design by SALLY HUANG

Mesopotamia

The Birthplace of Civilization

You might be wondering how society today developed— How humans learned to write, use agriculture, build architecture, and live together in large populations. If these are all questions you have, you might be surprised to find out that the answers can be traced back to Mesopotamia, which is known as the birthplace of civilizations.

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Design by SYDNEY LIU
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ANOUSHKA AMBAVANEKAR

Mesopotamia's name comes from Greek origins and translates to "the land between rivers"

This is because it was located between the Tigris and Euphrates rivers. Its location played an important role in its development as a civilization. This occurred around 4,000 BCE, which is about 6,000 years ago. The regular flooding of these rivers made the land fertile, or good for farming. People began growing crops and training animals to live alongside humans, which allowed them to live in one place and create villages, rather than constantly traveling. Eventually, these small villages were able to grow into early cities, where important characteristics of civilizations developed such as larger populations, division of labor, classes of people, and monumental buildings or architecture.

The climate and natural resources that were available at the time in early Mesopotamia were perfect for starting and growing a civilization. The climate was a lot wetter than it is today and in southern Mesopotamia, there was a marsh that provided resources such as food via fish and resources for construction like reed. Water was easily accessible and could be used for irrigation, which is supplying water to land to help crop growth. The marsh was also useful for developing long-distance trading with other places because it provided a connection to sea routes on the Persian Gulf. Northern Mesopotamia received a lot of rainfall, so farmers didn't need to do irrigation. They also had access to forests, which were

used to cut down wood and hunt for animals. Early Mesopotamian farmers' main crops were wheat and barley, but they also grew beans, peas, lentils, cucumbers, grapes, apples, and melons. They used domesticated sheep, goats, and cows as sources of milk, butter, and meat.

As climates grew harsher, the Mesopotamians had to work harder and become more organized in order to survive. In southern Mesopotamia, this led to the development of a system of government and a social structure where elites could ask workers to do labor in exchange for meals and wages.

Mesopotamia was the intersection of the Egyptian and the Indus Valley civilizations, which made it a melting pot of languages and cultures that allowed for a lasting impact on things like writing, technology, language, and trade. Mesopotamia eventually rose into empires like Akkad and Babylonia, whose capital city of Babylon became one of the largest and most advanced cities in the ancient world. Over many years, more civilizations appeared throughout the world and Mesopotamia gradually fell, which eventually led to society as we know it today.

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What will society look like in 100 years? How about 1,000?

While the future is uncertain, the formation of early civilizations and how Mesopotamia was the cradle of civilization is something we can be more certain about. Where Mesopotamia was once located, now lies modern-day Iraq and parts of Syria, Kuwait, and Turkey.

ANIMAL ARCHITECTS AROUND THE GLOBE

Writing by ERICA EDMAN | Editing by ANTONIO MELONI & LUKE ELGANT
Design by BAYLEY EAVEY

JAPANESE PUFFER

Male pufferfish work tirelessly for days on end to create a sculpture in the sand that is complex and precise enough to attract a mate. The 5-inch long pufferfish can create sculptures up to 7 feet wide - using only its fins! Once the fish starts his creation, he cannot stop or else the current will wash away all of his work. Each pufferfish works to make his sculpture perfectly symmetrical. If the pufferfish is able to successfully find a mate, the female will lay her eggs in the center of the magnificent structure.

GROUNDHOGS

Although this animal's artwork only exists below ground, the groundhog's complex habitat is truly a spectacular feat. Groundhogs use their curved claws and strong limbs to build tunnels for themselves underground. These tunnels are usually four to five feet below the ground and can reach up to 30 feet in length! The tunnel provides the groundhog with protection from predators, places to breed, and good locations to hibernate during the winter. Plus, one of the tunnels in a groundhog's underground home is used exclusively as a latrine - which means groundhogs basically build themselves their own underground toilets!

MALLEEFOWL

Malleefowl are a species of bird that cannot fly. Instead, they have a different, exceptional talent. In the winter, male malleefowls dig big holes in the forest floor. These holes can be up to 9 feet wide and 1 foot deep. As spring approaches, he begins collecting sticks, leaves, and bark to fill the hole. From there, the malleefowl uses these materials to construct a giant two-foot tall mound! The bird waits for rain to come, which allows the materials to mix, and then builds an egg chamber. The male malleefowl does all of this hard work to attract a mate that will lay her eggs on top of his mound.

BOWER BIRD

Bowerbirds build incredibly unique nests, called bowers, which are used by males to attract the attention of female mates. The male bird starts by plucking all of the leaves off of low hanging branches that block the sunlight from his chosen spot. Next, he needs to clear the area of all clutter. The bowerbird then searches for hundreds of small sticks and twigs that will make up the nest. The bird sticks the twigs into the dirt to create the walls of the nest. After this step is complete, the bowerbird collects larger one-foot-long twigs and lays them in two neat rows. At this point, the walls of the nest are as large as the bird himself! But, the bowerbird is not done yet. He then needs to venture into the woods and look for anything blue. These blue objects are what attract a mate, and what put the finishing touches on the bird's masterpiece!

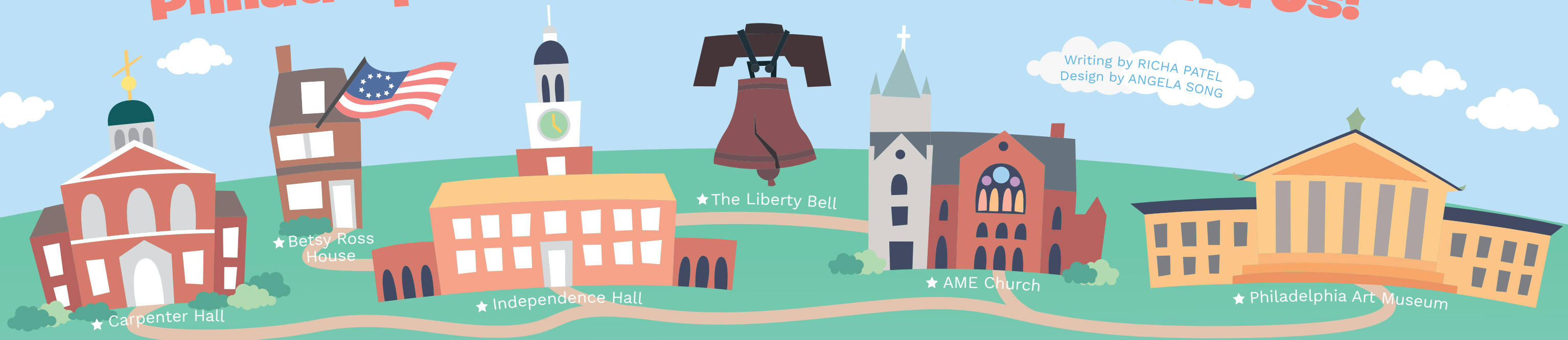
TRAPDOOR SPIDER

Trapdoor spiders spend most of their lives underground, and their unique habitats make it so they don't have to leave their homes to catch prey! The spider threads silk onto one side of the nest door, which acts as a hinge to open and close the door. The habitats are really difficult to see when the trap doors are closed because they camouflage perfectly with forests. The spider sit and wait for their prey with one claw resting on the underside of the door - ready to strike at any moment! Trapdoor spiders can sense vibrations above ground, and when they feel prey is close by, they jump out of their burrows to attack!

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Philadelphia's History: It's All Around Us!



From Independence Hall to the Rocky Steps, peeking just around the corner from you are pieces of American history. As one of the first cities ever created in the United States, Philadelphia has a very old and interesting past. Our city is home to a lot of different firsts – the first lending library, university, hospital, zoo, computer, and most importantly, the first ice cream soda. If you were to go on a walk around Philadelphia, you could see evidence of the city's history all around you.

It starts with Carpenter's Hall, which is a small building just a few blocks away from Independence Hall. The First Continental Congress met here in September 1774, where representatives from the 13 colonies met to discuss Great Britain's extreme taxes on the American colonies. At the end of the Congress, they decided to boycott all British goods until the taxes were lifted.

But that's not all – later on, Carpenter's Hall was used as the Bank of Pennsylvania, and soon became home to the first bank robbery in the United States, during the Yellow Fever. A man named Patrick Lyon was accused – and he had to break out of quarantine to travel to Philadelphia to clear his name. It turned out not to be him, but an employee of the bank: an inside job.

The Second Continental Congress met in 1775 in the nearby Independence Hall. This is where the American colonies truly became a country. If you go to the yard right in front, you'll almost be able to imagine being there on July 8, 1776. The date might ring a bell; that was when the founding fathers read the Declaration of Independence out loud in that very yard, declaring war on Great Britain. Rumor has it Philadelphia's bells tolled all night long to celebrate.

If you were to take a short walk from there, you might end up at the Betsy Ross house. This was where the first American flag was made. Betsy Ross lived here with other professionals, including a shoemaker, a shopkeeper, and an apothecary. According to legend, George Washington personally came to this house to ask Betsy to make the flag herself.

After the Revolutionary War, Philadelphia became the nation's capital, and landmarks from this time are present all over Old City. There's the first Bank of the United States, which was originally in Carpenter's Hall, but moved to a location on South 3rd Street soon after. Then, there's the U.S. Mint – where the first American money was created. Zooming back to Independence Hall, in 1787, the first U.S. Constitution was signed in that very building. And of course, there's the President's

House, where George Washington and John Adams lived during their presidencies. It is no longer standing, having been torn down in 1832, but it now serves as a memorial to the enslaved persons who worked there, showing the contrast between liberty and enslavement within the newly formed American nation.

Interestingly enough, the Liberty Bell has everything to do with this contrast as well. Known for years as the State House (Independence Hall) bell, it was rung to announce the Declaration of Independence, and on anniversaries of the founding of Philadelphia, but it didn't become the iconic bell we know it as until the anti-slavery movement. At this point, the bell was no longer able to be rung. Though nobody knows when the crack first came to be, it made its last sound on George Washington's birthday in 1846.

Written on the bell is: "Proclaim Liberty throughout all the land unto all the inhabitants thereof." In the mid-1800s, anti-slavery activists used this message as a rallying cry, and as such, named the State House Bell the Liberty Bell. It then became a symbol of activism movements throughout the country, for oppressed groups everywhere.

The Mother Bethel African Methodist Episcopal (AME) Church is also nearby, and is the first

church for America's first black denomination. It is the oldest piece of land continuously owned by African Americans in the entire United States. In the mid-1800s and Civil War era, this church was an important stop on the Underground Railroad for enslaved persons fleeing to freedom.

Philadelphia is still making landmarks even today. A relatively new landmark in our city are the Rocky Steps, which are the steps at the Philadelphia Art Museum. Based on the 1976 movie, "Rocky", Rocky is a club fighter who trains by running up the 72 steps, and after the worldwide fame the movies received, these steps became one of Philadelphia's most popular tourist attractions. These steps, and all other monuments that have been mentioned, are representative of the Philadelphia spirit: that through hard work and hustle, the underdog can win.

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THE NEUROSCIENCE OF CREATIVITY

Writing by ALY KERRIGAN | Design by ANGELA WU | Editing by ALBERTINA LEE & GRACE QIAN

Making art. Writing stories. Perfecting a recipe. Putting together an outfit. Crafting a caption for a new Instagram post. All of these are examples of ways we use creative thinking in everyday life. In reality, we activate our creativity all the time—when making decisions, solving problems, coming up with ideas, and more. But how exactly does thinking creatively work? More specifically, what parts of our brains are at play when we create?

Creativity is defined as the use of imagination to come up with original ideas. Psychologists, scientists who study behavior and mental states and processes, believe that creativity tends to follow a particular pattern, called the creative process. The first step to this process is preparation, where the creator (an artist, musician, or a kid like you!) reflects on past experiences and any previous creative work in order to prepare to create again. Next is incubation,

the time that is spent away from the creative project that provides a mental break (and often breeds unexpected insights). After incubation is the return to the project, a phase called illumination, where the ideas begin to come together. The last step of the creative process is verification, where the creator rates their work's worth. Neuroscientists, scientists who study the structure and functions of the brain, believe that creativity can also be defined as the brain's ability to make advanced connections, what some people call "thinking outside of the box." Examples of this kind of thinking include solving a tricky math problem by using a new method or making a unique piece of artwork. The field of neuroscience has proposed many ideas over the years about how the brain produces creative thought.

"Creativity is just connecting things. When you ask creative people how they did something, they feel a little guilty because they didn't really do it, they just saw something. It seemed obvious to them after a while. That's because they were able to connect experiences they've had and synthesize new things." -Steve Jobs

You might have heard the theory that people can either be "left-brained"—analytical and logical— or "right-brained"—creative and artistic. This concept came from the work of Nobel prize winner Roger W. Sperry, who proposed that humans are dominant in a particular side of the mind: either left or right. However, a 2013 study of over 1,000 brains proved that the human brain does not favor one side or another from person to person and that networks on both sides of the brain are equally strong. While this new research disproves Sperry's theory, his findings did touch on some truth about the presence of creativity hotspots within the brain.

Modern research indicates that certain areas of the brain do, in fact, have particular functions. The prefrontal cortex, which lies at the very front of the brain, is thought to be a hub for creative thinking. This area has been shown to activate during creative tasks, and damage to this area of the brain correlates to an impaired ability to do creative tasks like making art.

Three main networks within the brain also take control of the creative process and govern creative thinking. These large-scale networks span

both left and right hemispheres of the brain. One network is in charge of focusing on a task and is very important to complex problem-solving. Another is at work when pulling from memories to imagine things, like when daydreaming, trying to figure out what someone else is thinking, or predicting future events. The last network detects information and sorts through ideas. The interaction between these three networks has proven to be crucial in creative thought.

Since creativity is so complex, many different parts of the brain have to interact when we think creatively. Research even shows that the brains of more creative people may have more interaction between parts of their brains that may not typically communicate within other people's brains.

"The creative brain is wired differently... People who are more creative can simultaneously engage brain networks that don't typically work together." -Harvard psychology researcher Roger Beaty

People that are considered creative might just have more internal communication. Albert Einstein's brain, for example, did not have more numerous or larger neurons (brain cells) than the average person, but he did have more glial, "glue," cells in his brain. The job of these cells is to give nutrients to neurons and help communication between neurons. Psychologists believe that this increased "chatting" between his neurons is what made him such a creative innovator.

Einstein aside, how can the rest of us increase our creativity? Research shows that spending time reading and writing daily is a great way to engage multiple parts of the brain. Surprisingly, daydreaming can have a similar effect. By using past events to form new hypotheticals, the brain is using advanced creative thinking. Lastly, getting good sleep is vital to keeping a creative mind, so rest up!

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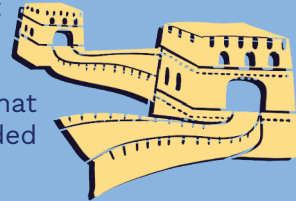
The Seven Wonders of Our Modern World

There is no better celebration of the heights of human creation and natural discovery than the Seven Wonders: breathtaking monuments big and small around the globe.



Great Wall of China: Across Northern China and Southern Mongolia

You can't see it from space, but that doesn't make the 5,500 mile long stretch of parallel walls any less impressive. It took 2,500 years to complete the Wall, with construction starting in the 7th century B.C.E. in the Chinese Zhou Dynasty and ending in 1878 in the Qing Dynasty. It was meant to prevent the northern nomads (Huns) from invading China ... that didn't work since they invaded anyway.



Chichén Itzá: Yucatán Peninsula

Chichén Itzá was a city founded by the Mayan civilization that ruled parts of modern-day Mexico and Central America. Some of its earliest buildings were constructed in the 6th century C.E. Later, invaders in the 10th century C.E. built monuments like the stepped pyramid El Castillo, which had 365 steps for each day of the solar year and the stone head of a snake at its base. Serpents were an important animal in Mayan culture and could be found throughout the city.



Petra: Southwest Jordan

Another ancient city! Petra was built in the 3rd century B.C.E. in Wadi Mūsā (Valley of Moses), where according to legend, the Hebrew prophet Moses struck a rock and found water. It was central to the spice trade of the Nabatean Arabic kingdom and featured multiple temples and water systems, boasting almost 30,000 citizens at its peak.



Machu Picchu: Near Cuzco, Peru

Machu Picchu, located high in the Andes Mountains, was created by the Incan civilization of South America around 1450. Machu Picchu was probably a sort of royal resort for Incan emperors, fitted with lodging for travelers (tambos), watchtowers, and mountainous steps for agriculture. The only thing missing was the water slide!

Christ the Redeemer: Rio de Janeiro, Brazil

A statue of Jesus Christ built atop the rocky peak of Mount Corcovado. Completed in 1931, it was made as a symbol of Brazilian national pride on the 100-year anniversary of the country's independence from Portugal. The Redeemer stands near the port with arms outstretched, as if embracing travelers to the important trading city. He's the largest Art-Deco architectural style sculpture in the world.



Colosseum: Rome, Italy

The Roman emperor Vespasian built this amphitheater (round arena), around 71 C.E. The building was a symbol against the cruel former emperor Nero's rule, created directly on top of his old private lake. However, cruelties persisted in the Colosseum; it became the holding ground for brutal hand-to-hand combat between gladiators (often Roman slaves) and men and animals. Yet it persists as an engineering wonder today, capable of holding 50,000 spectators.



Taj Mahal: Agra, India

This was built in the mid-1700s by the Mughal emperor Shah Jahān, who wanted a grand monument for the tomb of his late wife Mumtāz Mahal. The creation is made of white marble and includes a massive garden, complete with a reflective pool. Perhaps this wonder was a reflection of the emperor's immense love for his wife, or he just wanted to preserve his legacy. No matter his reason, the Taj Mahal's fusion of decoration and symmetry will continue to be one of the world's great achievements.



Writing by SRUTHI SRIVINAS • Design by XUE JIANG
Editing by ANOUSHKA AMBAVANEKAR & JOYCE LEE

The Origin of Basketball

Writing by KATRIN GROSS • Editing by TED DAVIS & ANTONIO MELONI

Basketball is the only professional sport to originate in the United States. Unlike other classic American sports, such as baseball and football which have their roots in similar sports from other countries, basketball is an American original. Since its creation, it has become one of the most popular sports in the world, but what would you say if you knew that the history of basketball began with a snow storm and peaches?

Before basketball, most of the sports played in schools in the U.S. were played outdoors. Sports like soccer and rugby were popular options, but they required a great deal of space. Since these sports were difficult and dangerous to play in cramped, indoor spaces, students were forced to turn to less exciting forms of exercise, like marching, during the cold winter months.

In 1891, a physical education teacher named James Naismith came across this problem. Naismith taught at the International YMCA Training School (now known as Springfield College) in Springfield, Massachusetts. When a winter storm prevented his students from playing sports outdoors, Naismith wanted to invent a game for them to safely play indoors. Naismith found two baskets that were used to collect peaches and nailed them to the 10 foot high railing of the balcony encircling the school gymnasium (that's why basketball hoops are 10 feet high today!). He split his students into two teams and charged each team with throwing a ball into the opponent's basket. Sound familiar?

Pro tip: peaches make a great courtside snack!

While modern basketball looks much like Naismith's original creation, there are some major differences. Notably, there was no dribbling in the original rules of basketball. Players could not run with the ball, so they instead had to throw it from the position that they caught it. Dribbling would have likely been difficult anyway as the first basketball games were played with soccer balls. Additionally, a person had to be positioned next to each basket to remove the ball when someone scored since they were real baskets rather than netted hoops, which weren't introduced until 1900. Each team also had more players, often 9 instead of 5, and the games were shorter, with two 15-minute halves instead of four 12-minute quarters.

Basketball was an immediate success. Naismith's new game proved to be an ideal winter sport; it was exciting, simple to assemble, and safe to play indoors. Within weeks of its invention, the original 13 rules of the game were printed in a college magazine and spread throughout the country. The first professional league, called the National Basketball League, was formed in 1898, and in 1905, basketball was recognized by the National Collegiate Athletic Association as a permanent winter sport.

If you're looking for something to do this winter, try checking out Philly's own team, the 76ers, or take part in a game at your school. Pro tip: peaches make a great courtside snack.

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Design by KAYLA KIM

MAKERSPACES

Writing by **JASON FISCHER** | Editing by **GRACE QIAN & JOYCE LEE**

When there's a maker, there's a space.

Are you someone who loves to imagine the possibilities of creation? Do you love making things for fun? Do you love to learn from others and work together? All of the above?

If so, a makerspace could be a great place for you to explore! Makerspaces are communities and platforms where people can work together, share knowledge, and try to make something new. While the history of makerspaces dates back to 1980 with computer programmers in Germany, makerspaces have come to be used in many different areas of interest. Some of these interests include woodworking, software, 3D printing, laser cutting, and engineering. However, a makerspace can be used for making really anything that you enjoy. Imagination and creativity have no limits, so neither do the possibilities of the makerspace community!

A makerspace does not have to be a physical place, and a great way to get involved in the maker community and express your creativity is through the website [Makezine.com](https://www.makezine.com). [Makezine.com](https://www.makezine.com) is created by the magazine that originally made makerspaces popular, and it includes tons of fun and accessible projects that you can recreate. One great example is a make-your-own ice cream project, where all you need is milk, cream, sugar, some Ziploc bags, salt, and ice. After about 10 minutes of shaking the ingredients together, you'll have made your very own delicious ice cream! Or, you could get some vegetable oil, gelatin, water, and juice to make your own sweet gelatin dots!

Another cool project for music (and physics!) lovers only requires a straw and scissors. After following the images provided on [Makezine.com](https://www.makezine.com) and cutting where instructed, you'll have your very own mini oboe. If you're really into it, you could even try using a tuner app on your phone to make sure that your oboe is up to par.

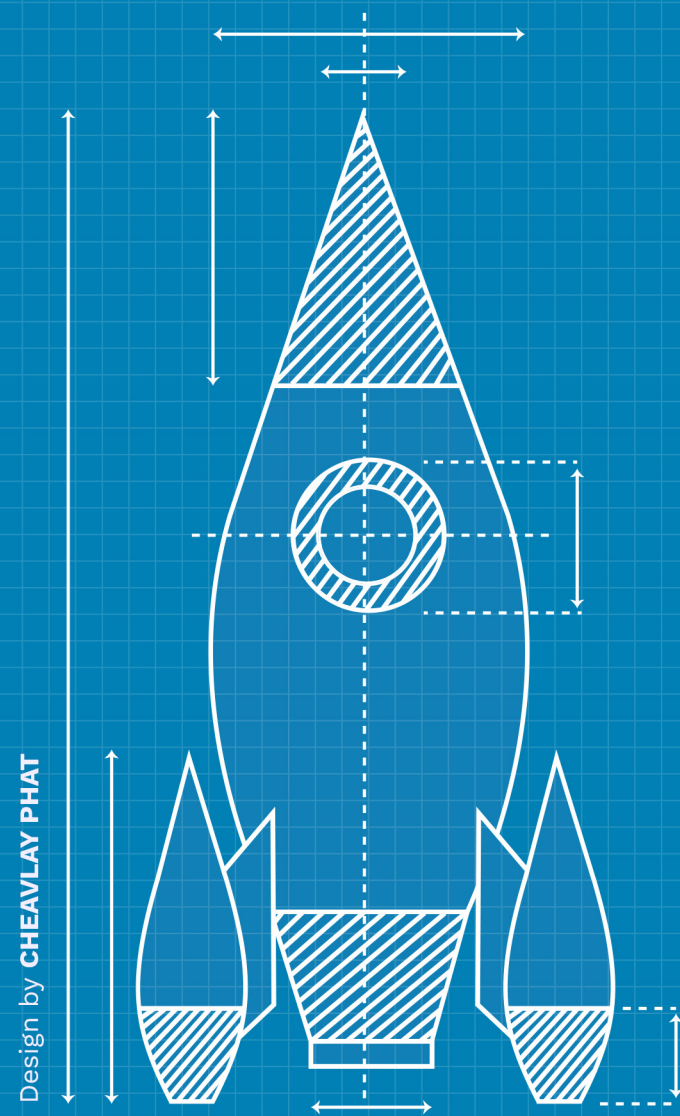
A cool in-person makerspace happens in Philadelphia once per year; every fall, Philadelphia hosts the Philly Maker Faire, where tons of people show off their creations of all kinds. This event provides a great opportunity to meet creative people like yourself and see the full possibilities of creation and collaboration. This year, it was even

held in the Independence Seaport Museum at Penn's Landing, so it is very accessible.

So, if any of these things sound exciting to you, you should definitely look into [Makezine.com](https://www.makezine.com) and the Philly Maker Faire. The more you express your creativity, the more fun you'll have!

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CREATION OF WIFI

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Design by **BAYLEY EAVEY**

Have you ever connected to a WIFI network and wondered how it worked? Well, whenever you search for something on the internet or even connect an item through Bluetooth, you use frequency hopping spread spectrum (FHSS). We use FHSS every single day, yet many do not know what it is and its interesting history.

FHSS was invented back in World War II by Hedy Lamarr and her partner George Antheil. During the war, enemy forces intercepted radio frequencies and used them to control ships and torpedos. This rendered them useless. Lamarr realized that enemy ships could easily interrupt these radio signals because the information was only being sent through one frequency. To counter this, FHSS was invented. Instead of using just one frequency, FHSS splits up the information and sends it through multiple frequencies. For example, if a car were driving in only one lane, it might encounter other cars or roadblocks. The best way for the car to avoid these obstacles would be to constantly be changing lanes. FHSS works in a similar way to the car in multiple lanes.

Although originally created for the military, you use this genius invention daily. When you connect to a WIFI network, the information you send out jumps through frequencies in order to protect the information. If FHSS was not invented, information could easily be taken from your phones, and wifi would constantly crash due to jamming and interruptions. Without the invention of FHSS, our world would look different.

Despite the importance of FHSS, we rarely hear about its creator. Hedy Lamarr was a Jewish woman born in Austria in 1914. After running away from home, she became one of Hollywood's most popular actresses. She was known for her beauty and acting skills. She was even said to be the inspiration behind Snow White and Catwoman. Yet, many did not know her true passion, inventing. It was often overlooked



Hedy Lamarr

because she was a woman, and to this day her invention has yet to be given proper credit. Although a patent was granted for her invention, the government seized it, due to Hedy Lamarr being a foreigner. The military even filed her patent away at first and said that FHSS was not efficient and too big.

Hedy Lamarr never received any compensation for her invention, which is said to be worth 30 billion dollars today. In 1997, however, she did receive the American Frontier Foundation Pioneer Award for her contributions to wireless communications. Hedy Lamarr stated, "If life kicks you in the teeth and the world doesn't recognize your achievements, do it anyways. What's important is that you tried to change the world for the better. That is what you will remember. The applause doesn't matter; what matters is the doing." She has motivated so many people and maybe one day you will invent and CREATE with her as your inspiration.

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Famous Replicas Around the World

Landmarks Re-Created

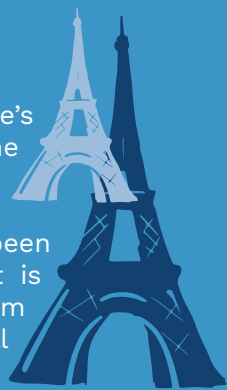
Writing by AMALYA KNAPP | Design by SYDNEY LIU | Editing by LEEYU ADDISU & ALBERTINA LEE

We've all heard the phrase "imitation is the sincerest form of flattery." When it comes to replicas of famous landmarks, there is a lot of flattery going on. Some of these copies were built as tributes to the majestic originals, while others were created to make these landmarks accessible for people who cannot visit the originals. Here are some replicas of important architectural and cultural landmarks around the world!

The Eiffel Tower

Las Vegas, Nevada

There are many replicas of France's Eiffel Tower around the world, but the largest one is located in the Paris Las Vegas Hotel and Casino. In fact, this Eiffel Tower replica has been featured in many movies, since it is often easier (and cheaper) to film scenes in Las Vegas than traveling all the way to Paris!



The Leaning Tower of Niles

Niles, Illinois

Half the size of the Leaning Tower of Pisa in Italy with the same iconic tilt, this replica was actually built for a practical purpose: to hide the city's water tanks in the ground. 57 years after it was constructed, the city of Niles established a "sister city pact" with Pisa in honor of their matching leaning towers!



The Statue of Liberty

Birmingham, Alabama



The Statue of Liberty is another well-known symbol of American freedom, but the Statue of Liberty replica in Alabama was actually created as a symbol for Liberty National Life Insurance Company. Though the replica was originally placed atop Liberty National's home office building, it was later moved to a park so that it could be enjoyed by the public. Fun fact: this Statue of Liberty replica was officially dedicated on July 4, 1989, in celebration of Independence Day!



The Taj Mahal

Sonargaon, Bangladesh

The original Taj Mahal in India is an extravagant monument housing the tomb of the wife of India's 17th century emperor, Shah Jahan. A slightly smaller, but just as beautiful, replica of the Taj Mahal was built in Bangladesh in order to allow his country's poorer residents to see the famous site, or one that is almost exactly like it.

The Liberty Bells

Philadelphia, Pennsylvania

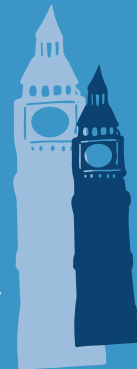
Did you know that each of the 50 states contains a replica of our beloved Liberty Bell? The famous symbol of freedom has even been copied internationally, in Tokyo and Jerusalem. Luckily for us, we don't have to travel far to visit the original!



The Big Ben

Mysore, India

The original Big Ben in London was built simply to serve as the clock of the city, and this replica is no different. The Big Ben of India is even taller than the original!



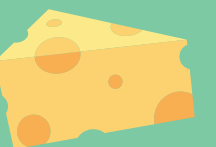
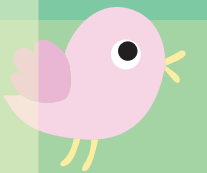
This is just a short list of the many, many famous replicas around the world. **Which would you like to visit first: the originals or the copies?**

REFERENCES
 1. Bullen, C. (2022, April 27). "Seeing Double: 9 Replicas of the World's Most Famous Attractions - Travel Inspiration." Viator.
 2. (2014, August 27). "Replicas of Famous Landmarks - Torre Eiffel, Leaning Tower of Niles, and More." Thrillist.
 3. Sørensen, SG. (2016, October 5). "10 curious replicas of world-famous landmarks - momondo Discover." Momondo.

WORD SEARCH



H	D	E	C	N	E	I	C	S	O	R	U	E	N	R
Y	R	V	P	B	A	S	K	E	T	B	A	L	L	Y
R	I	E	N	V	Z	H	Q	N	V	W	U	K	Y	R
E	B	P	S	K	F	U	E	Y	L	F	G	P	S	R
N	R	R	M	D	S	D	G	N	I	N	O	L	C	E
N	E	C	U	A	I	E	A	U	A	X	I	A	U	B
E	W	W	O	C	K	D	V	P	D	H	Y	Q	T	E
T	O	L	C	L	P	E	N	I	C	I	L	L	I	N
R	B	A	A	L	O	D	R	T	T	C	R	C	K	I
E	D	Y	G	A	I	S	M	S	E	A	O	B	U	P
P	X	P	T	Q	U	M	S	M	P	M	E	V	Y	C
L	O	E	P	M	N	L	X	E	Z	A	K	R	W	H
I	S	Y	X	O	X	O	X	G	U	U	C	I	C	I
C	Z	X	K	A	B	A	D	V	S	M	F	E	L	M
A	M	E	S	O	P	O	T	A	M	I	A	G	Z	V



Creative
Bowerbird
Accident

Penicillin
Colosseum
Rennet

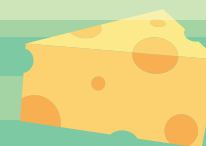
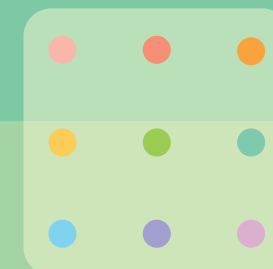
Wifi
Cloning
Hybrid

Pineberry
Mesopotamia
Makerspace

Replica
Neuroscience
Basketball

NINE DOTS

Without picking up your pencil, connect the 9 dots in each grid with as few straight lines as possible!

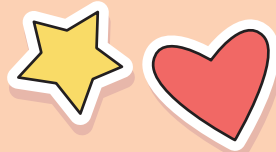
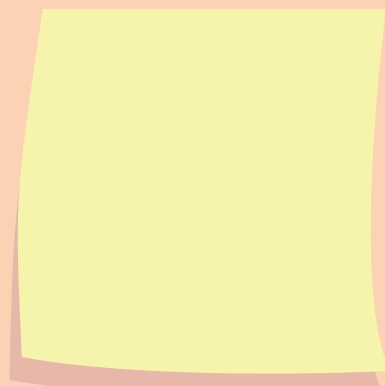
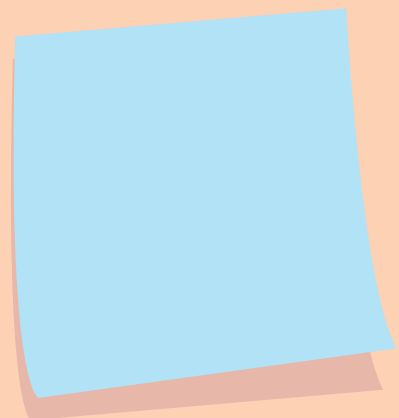


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What is a creative idea you have?

It can be anything! Song lyrics, a crazy invention, or even a joke!



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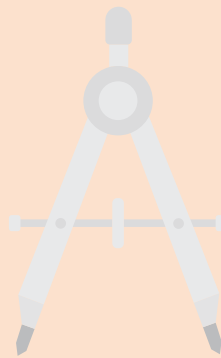
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