Students- choose one article from the 4 below and write your personal response. Submit your response before July 31.

Article #1

Different types of brain cells participate in mammal navigation

By Scientific American, adapted by Newsela staff

01.25.17

How do humans and other animals find their way from point A to point B? This apparently simple question has no easy answer. But after decades of extensive research, a picture of how the brain converts space into code and enables us to navigate through it is beginning to emerge. Earlier, neuroscientists had found that the mammalian brain contains at least three different cell types, which cooperate to encode neural representations of an animal's location and movements.

But today, new research now points to the existence of two more types of brain cells involved in the navigation of space. This suggests previously unrecognized neural mechanisms underlying the way mammals make their way about the world.

Earlier work revealed that neurons called place cells fire when an animal is in a specific location. Another type — grid cells — activate periodically as an animal moves around. Finally, head direction cells fire when an animal moves in a particular direction. Together, these cells, which are located in and around a deep brain structure called the hippocampus, appear to encode an animal's current location within its environment by tracking the distance and direction of its movements.

Goal-Direction Cells

The question of how the brain converts the endpoint of a journey has remained unanswered. To investigate this, Ayelet Sarel of the Weismann Institute of Science in Israel and her partners trained three Egyptian fruit bats to fly in complicated paths and then land at a specific location where they could eat and rest. The researchers recorded the activity of a total of 309 hippocampal neurons with a wireless electrode array.

About a third of these neurons exhibited the characteristics of place cells. Each of them fired only when the bat was in a specific area of the large flight room. But the researchers also identified 58 cells that fired only when the bats were flying directly toward the landing site.

“We have discovered a totally new kind of neuron, which we are calling 'goal-direction cells',” says Nachum Ulanovsky. Ulanovsky is the senior author of the study, which was published this week in the journal Science. The findings, he adds, explain how the brain encodes navigational goals.

The new cells continued to fire when the landing site was hidden from the bats' view by a curtain. “The bats knew where the goal was, but could not echolocate or see the goal behind the curtain, but the goal-direction neurons still represented the hidden goal. This means that the representation of goals in the bat hippocampus was not merely sensory-based, but was memory-based.” Neuroscientist Hugo Spiers studies the cellular basis of spatial navigation at University College London. He says the findings are “hugely important” — but he does not think goal-direction neurons are a new cell type. He says the results show that place cells are capable of more varied information processing than previously thought.

Hippocampus Guidance System

Nevertheless, the new findings echo the results of a brain scanning study published by Spiers and his partners in 2014. It showed that the human hippocampus contains a flexible guidance system that encodes both the distance to the goal as the crow flies and the actual route that has to be taken to reach it. “This paper now validates it at the cellular level,” Spiers says. The findings could also explain why rats with damage to the hippocampus have difficulty remembering the location of a submerged platform within a water maze. In another series of experiments, Sarel and her partners identified another subpopulation of hippocampal neurons that appear to calculate and encode the distance to the goal. These “goal-distance” cells became highly active only when the bats came within 2 meters of the landing site.

A separate study was just published in Nature Neuroscience. In this study, Jacob Olson of the University of California, San Diego, and his partners recorded neuronal activity in the hippocampus of rats. The animals ran along six interconnected routes resembling a city grid, or foraged around an open space, as their activity was recorded.

The scientists found that 47 of the 542 cells whose activity they recorded were strongly tuned to a specific axis of travel. These cells fired only when the rats moved in either direction along a single axis. For example, some of these neurons were selectively activated when the rats moved from north to south, and also when they moved south to north, but not when they ran in either direction along the east-west axis. Others were activated in response to movements along other lines of travel — but again, only in directions that were 180 degrees apart.

Olson and his partners argue that these "axis-tuned" neurons are distinct from head direction cells. This is because they only fired when the rats moved along specific paths — and fell silent while the rats foraged around the open space. Head direction cells, by contrast, fire when rats move through open spaces in a specific direction. But another recent paper provides evidence that head direction cells can encode opposite directions. Thus, axis-tuned neurons may in fact be head direction cells after all, albeit ones that are performing a previously unknown function.

The Brain's GPS

All of this makes the "brain's GPS" even more complex than scientists had previously thought. The new work from Olson suggests that the hippocampus represents direction by encoding the axes of travel. These mental representations may enable us to stay on the right track despite having to navigate obstacles such as roadblocks. The bat study further suggests that the hippocampus not only encodes location by tracking the distance and direction movements. It also encodes a representation of both the direction and distance to the destination. The brain's navigational system would thus have a "homing signal," and also appears to be endowed with its own goal-finding neurons.

Article #2

Drones in the Medical Field

BALTIMORE, Md. — Aerial drones could one day ferry life-or-death medical supplies between hospitals, thanks to Johns Hopkins Medicine researchers. They have figured out how to keep blood, medications and vaccines consistently cool during the flights.

Interest in the use of the unmanned aerial vehicles has surged in recent years. Companies, including retail giant Amazon, are exploring the use of the aircraft to efficiently and cheaply carry goods. Drones can go above traffic, through bad weather and to otherwise hard-to-reach areas.

Plan Takes Off

“If the blood somehow was changed or destroyed in transport, then none of it matters,” said Dr. Timothy Amukele, a pathologist and director of the Hopkins Bayview Medical Center’s clinical laboratories. He spent 18 months on a team perfecting refrigeration on drones.

Amukele published findings in the journal Transfusion in November that showed no biological change to blood packed in refrigerated coolers during test flights. The drone flights lasted about 26 minutes and covered 12 miles at 328 feet above ground.

Amukele hopes to begin sending lab samples and other materials between the Bayview campus and Johns Hopkins Hospital less than three miles away. He still needs buy-in from neighbors who might hear buzzing overhead. He also needs approval from the Federal Aviation Administration, which recently issued regulations involving drones.

Other Baltimore-area hospitals and eventually farther-flung medical facilities could be looped in, enabling them to share limited medications and blood products. The flights could also make advanced lab testing more accessible. Eventually, Amukele envisions

emergency workers requesting pints of blood to be delivered to the scene of accidents and natural disasters.

Privacy Concerns Over Use

“Drones may become a realistic option,” said Ian Weston, executive director of the American Trauma Society, an organization of care providers for serious injuries.

Rapid delivery of supplies by drone would save lives when patients can’t be taken quickly to a hospital by ambulance or helicopter, Weston said.

He said patients in 90 percent of the country can get to a trauma hospital within 60 minutes. That is known as the all-important “golden hour.” It was first described by Dr. R. Adams Cowley, for whom the Maryland Shock Trauma Center is named.

Communities likely would support use of drones for life-saving medical supplies, just as they have embraced helicopters, Weston said. Drones with cameras are already used to view large fires and accident scenes, he noted. However, more widespread use could prompt privacy and security concerns. In some other countries, drones have been used for surveillance. They are also used by militaries to fight wars.

Questions remain about drone capabilities and what the FAA would allow. The agency now bans drones over 55 pounds, flying faster than 100 miles per hour or higher than 400 feet, and the pilots operating them remotely must be certified. More paperwork is needed to fly over certain places and distances.

Solving the refrigeration problem, however, at least makes drone use possible, Weston said. But he and others warned that more trials will be needed to show if drones are better than other delivery options.

"An Issue Of Risks, Benefits And Costs"

Dr. Thomas M. Scalea, Shock Trauma’s physician-in-chief, said the Hopkins researchers answered a big question about “if we could do it, but now we have to ask if we should do it.”

Drones might not be worth pursuing yet if they often crash or miss their mark, don’t improve patient outcomes or cost a lot to operate. Scalea said he’d like to see whether

drones could help hospitals share resources. However, he cautioned officials to resist the temptation to just run with the new technology.

“It’s an issue of risk, benefits and costs,” Scalea said. “If you could devise an incredibly reliable way to deliver what you want to deliver and be quicker than going on the roads, and you could make it as cheap as driving, then you’ve got something. We’re a little ways away from that." He added that at least now, "it’s possible to ask the questions.”

There might not be widespread need for blood at accident scenes because it’s still most important to get patients to the hospital, said Scalea and Dr. Peter P. Taillac. Taillac is a professor of emergency medicine at the University of Utah School of Medicine.

Emergency workers are more likely to turn to blood-clotting advances such as freeze-dried plasma that can be rehydrated with saline. Blood might be needed if patients are stuck in the field or when natural disasters result in many victims, Taillac said.

Bringing Help To Remote Areas

He sees other uses for drones, however, such as on-demand access to expensive and rarely used drugs, such as an antidote to rattlesnake bites. He also noted some Canadian university students are developing another use. It is a system to deliver automatic external defibrillators, or AEDs, directly to bystanders to use on heart attack patients.

“What are all the niches we can fill?” he said. “There are probably more than 100.”

Other groups, including the medical aid group Doctors Without Borders, are already exploring drone use in the field. The group worked with the California-based company Matternet in 2014 to send samples via drone from patients with suspected tuberculosis. The drones went from remote health centers in the Pacific island nation of Papua New Guinea to a hospital in Kerema, a regional capital. Officials are exploring ways to send back results and treatments.

Matternet also has said it would develop drone systems in the Dominican Republic and Malawi to send medical tests and blood samples from remote villages to labs. The flights would bypass muddy roads and dangerous waters.

A San Francisco-based company called Zipline is working with the government of Rwanda in central Africa to parachute blood products to remote areas from drones. The firm plans eventually to expand to other products and countries.

Article #3

Coca-Cola's grasp on Japan's beverage market includes many quirky drinks

By Associated Press, adapted by Newsela staff

12.02.16

EBINA, Japan — Coca-Cola has been the top beverage maker in Japan for half a century, but it's not because of the popularity of Coke. Instead, the American soft-drink brand has adapted to the quirky ways Japanese society quenches its thirst.

Coca-Cola's nearly 1 million vending machines account for about half of all the vending machines in Japan. Many of them do stock Coke and Coke Zero. Most of the beverages sold by those state-of-the-art machines, however, have nothing to do with the soda that shares the company's name.

Among the bigger favorites are "Georgia" brand canned coffee, orange-flavored water and of course, green tea, the traditional drink of choice.

Riding The Funky Beverage Trend Bandwagon

Japan is The Coca-Cola Co.'s second-biggest market after the United States, raking in more than 1 trillion yen ($10 billion) in annual sales. But consumers here are not crazy about bubbly drinks like Fanta and Sprite, other U.S. favorites.

Instead, the notoriously fad-loving Japanese jump from one trend to another across an array of weird product offerings, such as carbonated drinks with odd flavors like smelly durian fruit or garlicky kimchee. These are mostly attention-getting products intended for fun.

Though its product offerings don't go quite that far, Coca-Cola has 850 different beverages in Japan alone, not counting discontinued brands. Among the most popular is Qoo, a water-drop-shaped forest creature.

"It is so difficult to survive," said Takashi Wasa, senior vice president at Coca-Cola.

The odds of having a hit are "maybe just three out of a thousand," he said.

Coca-Cola's Global Grasp

Twenty Coca-Cola global brands bring in $1 billion or more in annual sales. Four came from Japan: the Georgia coffee lineup, Aquarius (a Gatorade-like drink), I Lohas bottled water and Ayataka green tea. Other global top-sellers are Coke drinks or companies like Minute Maid and Matte Leao that Coca-Cola purchased.

Matte Leao is an herbal tea extremely popular in Brazil. It is an example of adapting to local tastes.

The company's Japan operations take that to an extreme, said Raymond Shelton, senior executive officer for Coca-Cola East Japan.

"I have traveled the world for Coca-Cola, and I have never seen such a variety of products, and such an intensive pace of new launches," he said. "Japanese consumers ... have a much broader set of demands."

Green Tea Parade

Over the past decade or so, green tea has grown into a 777 billion yen ($7.5 billion) packaged beverage market in Japan. Many Japanese now prefer tea conveniently packaged in plastic bottles, rather than steeped in teapots.

That makes Ayataka, which sells for 140 yen ($1.30) for a half liter (1 pint) bottle, an important brand for Coca-Cola. Developed in partnership with 1,600-year-old Kyoto-

based tea grower Kanbayashi Shunsho, Ayataka is also sold in Singapore, Hong Kong and Taiwan.

Ads for Ayataka tea feature a taste test by Kyoto apprentice geishas. Japanese chefs vouch that its flavor is indistinguishable from tea brewed in a teapot.

Unlike acidic bottled Coke, green tea requires special precautions during its bottling to prevent spoilage and preserve its flavor. Coca-Cola has invested about 40 billion yen ($360 million) since 2014 to double its assembly lines in Japan to nine and accommodate such production.

At Coca-Cola's plant in Ebina, southwest of Tokyo, bottles and caps are splashed with a decontaminating chemical, and then rinsed with blasts of water. Bottles filled with tea from giant vats flash by, 900 per minute. They are inspected, labeled and then boxed in robotic lines. A non-stop parade of bottled teas circles the plant round-the-clock.

"Weird Items" Wanted

Since retailers only stock in-demand products, pressure is high to keep coming up with new products, or at least new adaptations.

Coca-Cola's competitors in this tea growing nation were quick to imitate Coca-Cola's lead in adding powdered tea to green tea drinks. It makes them cloudier and more like richer-tasting teas out of a teapot.

Some products are specifically developed as "kawaridane" or "weird items," just to attract attention, like cucumber-flavored Pepsi or one with extra fizz.

"It's that extra burp factor," said Akira Kiga, a spokesman for Suntory Beverages & Food, which sells Pepsi in Japan and trails Coca-Cola with the second-largest market share. "We want people to notice and see that we're a fun brand."

Still, when it comes to solid earnings, Suntory, like Coca-Cola, is counting on three groups — water, coffee and green tea.

"We do want to work on building strong brands that have staying power," Kiga said.

Teas Sneak Up On Cokes

Yoshiyasu Okihira analyzes stocks at SMBC Nikko Securities in Tokyo. He estimates that carbonated beverages like Coke and Fanta make up one-fifth of Coca-Cola's Japan sales, with coffee and tea accounting for 40 percent.

Coca-Cola's legions of vending machines, many offering piping-hot drinks on chilly days, are a big asset. To capitalize on that advantage, the company is introducing smartphone applications that award one free drink for every 15 bought from Coca-Cola vending machines. Others send Spotify music playlists depending on the drink purchased.

The Japanese tea products are a strong asset in global markets as people become increasingly health-conscious. Japan, with its aging and picky consumers, increasingly is leading such trends, Okihira says.

"Roasted barley tea, for example, has global potential, and Americans may really like it," Okihira said.

Chicken, Fries And A Coke

Like many Japanese, 50-year-old cab driver Masataka Sakabe drinks a variety of beverages every day, including canned coffee to stay awake on long shifts. He also loves Coke, especially with greasy foods like fried chicken or french fries.

"I love Coke, the red kind, not the diet kind, that original flavor. It makes you feel so refreshed," he said.

Artice #4

Explainer: This is your brain

The Conversation, adapted by Newsela staff

If asked 15 years ago to write a short piece about what the different parts of the brain did, it would have been a fairly straightforward task. Not anymore.

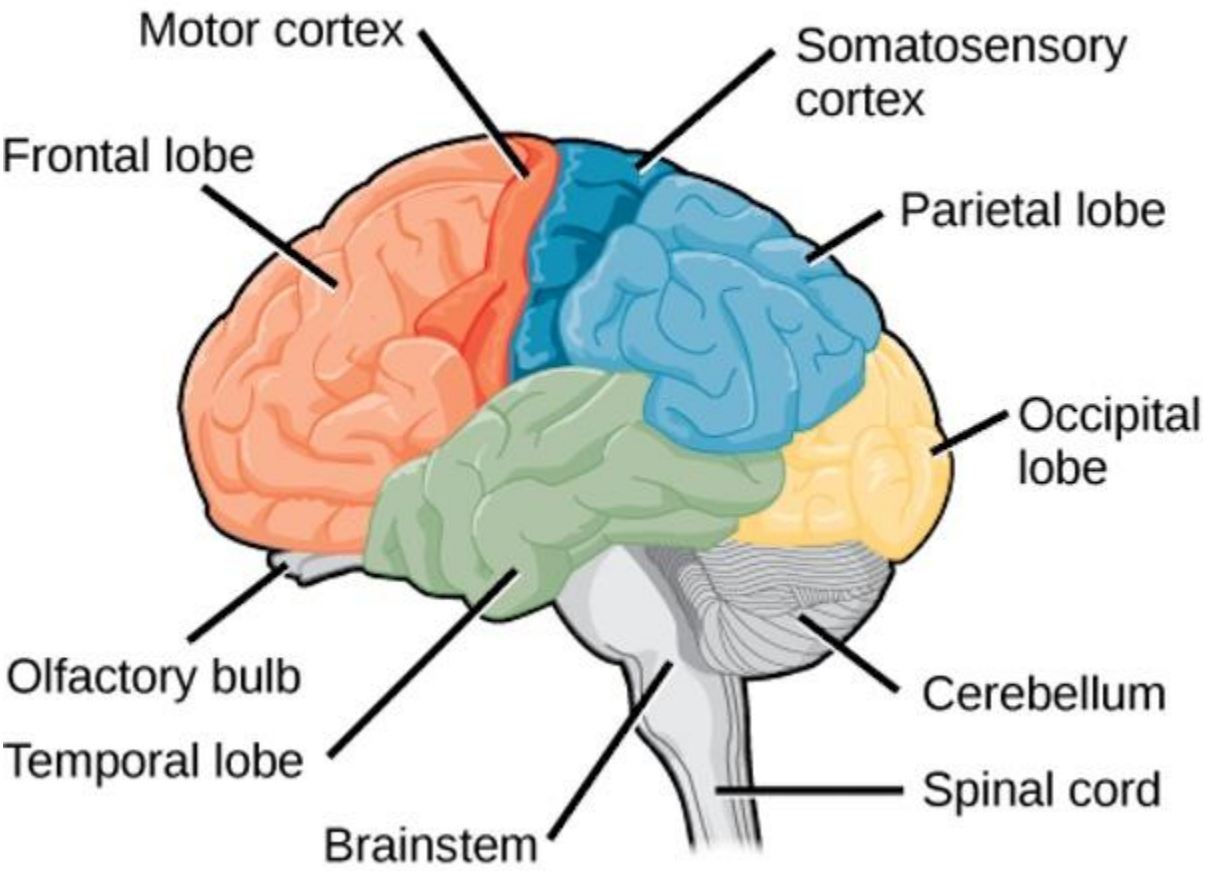
Over the last 15 years, the methods used to study the brain have advanced significantly, and with them so has scientists' understanding of the brain. This makes the task of explaining the most complex organ in the body, well, complex.

Assignment Of Brain Functions

The structural anatomy of the brain is certainly well-defined and the more basic of its functions have been generally well-mapped. The “lower levels,” such as the brainstem, regulate functions such as heart rate, breathing and maintaining consciousness.

The cerebellum is critical for the control and regulation of movement. While it was once thought that this was its sole function, more recently the cerebellum has also been shown to have a role in so-called “higher functions” such as cognition and emotion.

In the "higher levels" of the brain, namely the cerebral cortex, more complex functions come into play. Here the assignment of function to structure becomes decidedly less distinct.



The cortex is divided into two hemispheres (left and right), each with four lobes (occipital, parietal, temporal and frontal).

Brain functions have been traditionally assigned to one such lobe and/or hemisphere of the brain. These include functions such as visual perception, language, memory, spatial ability and problem-solving.

This division of functions has led to some confusions regarding brain function.

Right Brain Versus Left Brain

The most popular misunderstanding is the commonly held belief that there is a distinction between the left “logical” brain and the right “creative” brain. However, such complex behaviors are not determined by a specific brain region or even a specific hemisphere.

The idea of an almost one-to-one relationship between structure and function was largely a result of lesion studies, where damage to a specific part of the brain resulted in

impairments in a particular function. But as techniques for assessing the brain became more sophisticated, this approach was shown to be somewhat simplistic.

Science has come a long way from the phrenology of the 19th century in which characteristics such as secretiveness and self-esteem were determined by the shape of the skull. It has also come a long way from the 20th-century reliance on lesion studies to determine the function of the different areas of the brain.

The Networking Of Higher-Level Functions

Scientists are now developing an understanding that complex, higher-level brain functions are a result of a number of brain areas working together. These brain areas work together in what are called "networks."

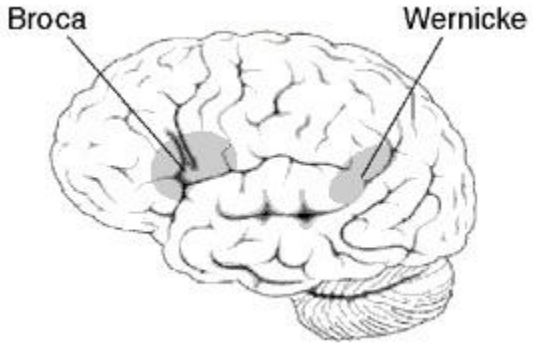
Scientists know this because of techniques such as Magnetic Resonance Imaging (MRI), which allows them to look at the entirety of brain regions involved in certain functions. Newer applications also allow scientists to picture the connections between these regions.

This is not to say that there is no separation of function throughout the brain. Rather, while there are brain regions that carry out specialized functions, they are now thought to do so in concert with other brain regions through network connections.

To conceptualize this, it helps to think of the brain as an exceptionally efficient rail network. Certain train stations perform specialized duties, but they do so in conjunction with other stations, and they are connected and "communicate" through the rail network.

Language can provide a good example of how this occurs in the brain. Language is often thought of as a solely “left brain” function and, while this is somewhat true, it is certainly not the whole story.

Brain's Unique Language



There are specific regions in one (usually the left) hemisphere of the brain that are essential for producing and understanding speech. These parts of the brain are known as Broca's area and Wernicke's area.

But the other (usually the right) hemisphere of the brain is also involved in language. It is thought to play an important role in recognizing and producing the emotional aspects of speech.

Additionally, the "language network" involves a number of other "left" hemisphere regions. These include the prefrontal cortex, premotor cortex, supplementary motor area, as well as regions of the parietal and temporal lobes.

Together, these brain regions work to perform higher-level aspects of language such as mapping words to their meaning.

While there are certain highly specialized brain regions for language, they are still part of an extensive network. These brain regions all work together to produce this complex function.

In addition, the brain is not fixed in its functioning. It is adaptable and, if needed due to illness or injury, it can recruit new regions and/or networks to take over the functions of the damaged areas.

And so scientists believe it is a complex interaction between structure and function that best describes what the different parts of the brain do – at least for now.