Some interesting and useful brain notes

Why is the brain divided in two?

Our brain has two hemispheres, the right and the left. They share our thinking and the control of our body. The left half of the brain controls the right side of the body and the right half of the brain controls the left side.

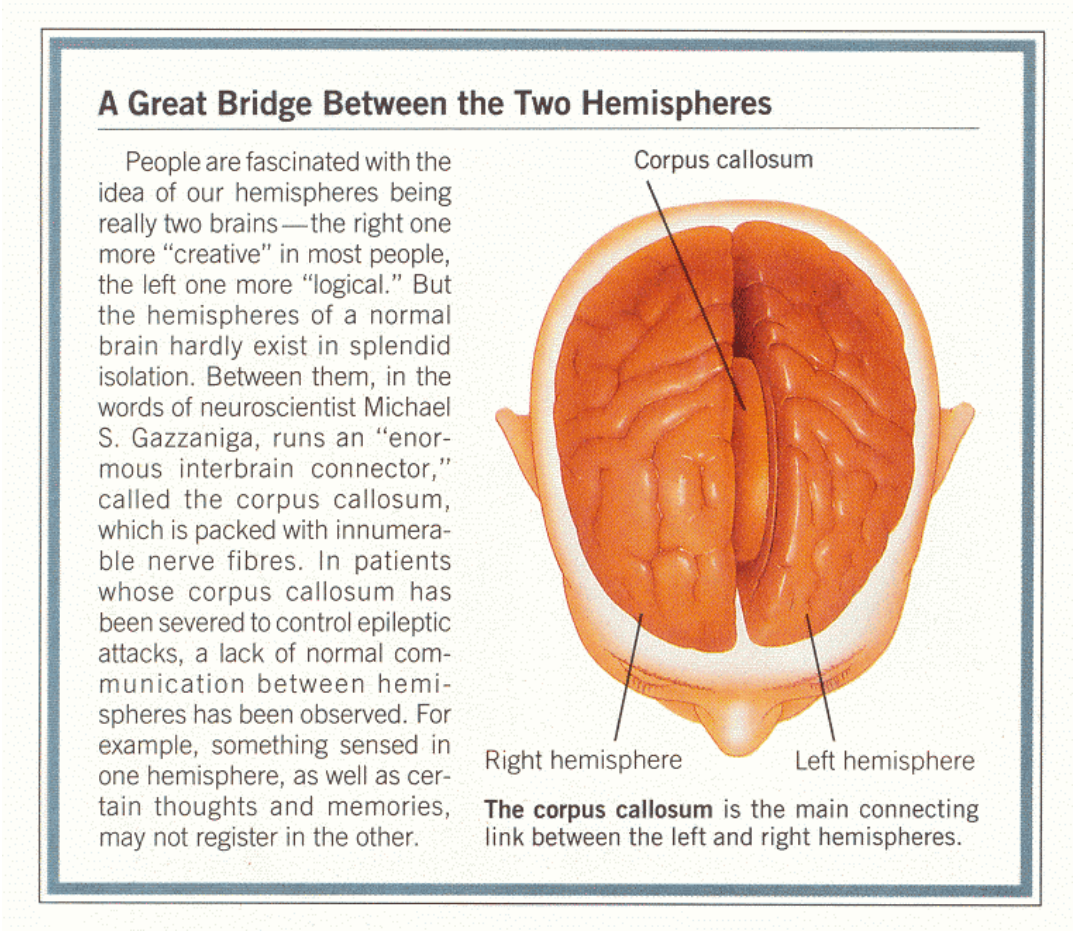
One theory on why the brain is divided down the middle is that each half can provide a backup if the other is damaged. This duality is common in other internal organs, such as the lungs and kidneys, and of course in eyes, ears, limbs, and so on.

When injury to the brain occurs at birth, a healthy hemisphere can often take over successfully the function of the damaged one. infants who have had a hemisphere removed surgically have shown relatively normal physical and mental development. A stroke in a child of six or seven often does not severely impair language development, although in an adult it could mean permanent loss of speech. This adaptability diminishes as a child grows up and the hemispheres become more specialized.

Although our brains are divided in half, the two halves are not identical. For that matter most persons have faces that aren't quite symmetrical, and one foot that is usually a bit larger than the other. The asymmetries in the brain's halves are a clue to the different specialties of each hemisphere.

Is each hemisphere really an independent brain?

In the early 1940's, brain surgeons began to treat sufferers from lifethreatening epilepsy by cutting the major nerve link, called the corpus callosum, between the two halves of the brain. In an epileptic attack, the brain's neurons sometimes discharge in an abnormal, erratic way, sending what have been described as electrical storms across the corpus callosum. The neurologists thought that cutting the corpus callosum might calm these storms, and up to a point they were correct. The operation reduced epileptic seizures and left the patients otherwise apparently unchanged.



Cutting of the corpus callosum became a frequent treatment for intractable epilepsy. Follow-up studies of the split-brain patients led to the popular belief that we have two brains in our heads. That is, each hemisphere is capable of working independently, and we can get by with one or the other.

However, later studies revealed that although separated hemispheres can function well, a split-brain patient may have measurable deficits in connecting images and language. Normally, the two hemispheres don't operate independently, but interact.

What makes you right-handed or left-handed?

Why some 90 percent of people possess a greater degree of strength and coordination in their right hands than in their left-and why the opposite is true for the other 10 percent-is something that remains unexplained.

There are many theories. The Greek philosopher Plato believed that humans were by nature ambidextrous, and the “folly of our nurses and mothers” imparted the “bad habit” of right-handedness. Today, theories on why individuals have a dominant right or left hand tend to place more emphasis on inheritance and less on learning. Even infants seem to demonstrate, by the direction in which they turn their heads and by their strength of grip, a preference for one side over the other.

If your parents are left-handed, the probability that you will be, too, is 23 times higher than if both parents are right-handed. British researcher Marian Annett thinks that most people are born with a gene inclining them to right-handedness. The 18 percent without this gene, she suggests, become lefties or righties depending on childhood influences.

Other theories propose that foetal or birth events may be a cause of lefthandedness. Among twins - who are somewhat more prone than single babies to foetal injuries - the incidence of left-handedness is more than double the average. However, there is not conclusive evidence that left-handed people have experienced any form of brain damage.

What is it like being left-handed in a right-handed world?

Many left-handers today remember being told in school not to use their left hand for writing, and how difficult it was to oblige. The left-handed author Michael Barsley has written of his kind, “It is remarkable that so little has been written about this minority, and the prejudice against it."

The bias against left-handers is ancient and deep-rooted, although its origin is impossible to trace. Perhaps it stems from some instinctive human distrust of difference. Or perhaps the explanation lies in ancient codes of hygiene that decreed the right hand should be kept clean for eating, leaving the left to do dirtier tasks. In Europe in the Middle Ages, left-handedness was associated with witches and devils. in areas of rural Japan, left-handed women had to hide their handicap in order to find a husband. Cultural anthropologists surmise that right-handedness has been the norm throughout history.

In our right-biased world, lefthanders suffer many inconveniences: scissors, can openers, tools, sports equipment, office furniture, and knitting instructions are designed for use by right-handers. However, a few companies now offer products made specially for left-handers.

Can some people do things equally well with either hand?

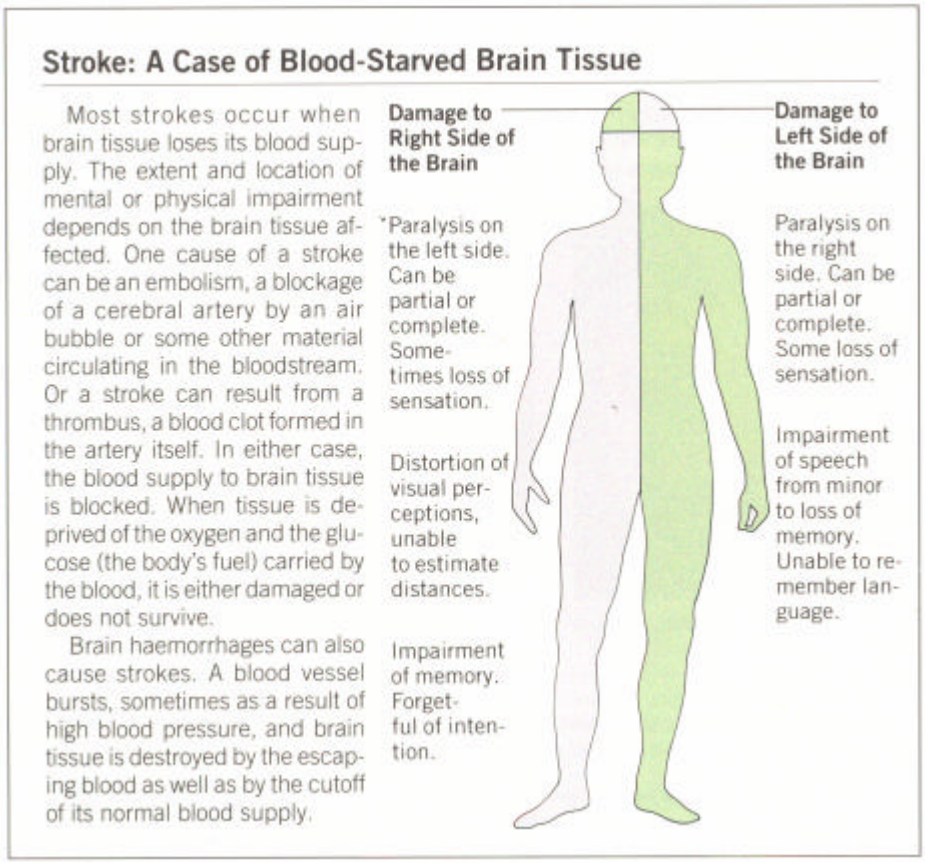
Nineteenth-century British artist Sir Edwin Landseer entertained party guests by simultaneously drawing a horse with one hand and a stag with the other. This super-achiever among the ambidextrous (literally, "doubly right-handed") was, in fact, not outstandingly rare in being able to do skilled work with both hands. Tests used to determine handedness find many people who switch hands to do different tasks.

It is still unclear, however, whether there are degrees of handedness that fall on a continuum between two extremes, or whether there are just three distinct categories of handedness: left, right, and ambidextrous.

What are the specialized abilities of the brain's two hemispheres?

The notion that we carry two independent brains in our head is somewhat misleading, but each hemisphere does seem, as a rule, to specialize in (though very rarely monopolize) certain functions. The left brain's specialties are spoken and written language, logic, number skills, and scientific concepts. Work that might involve primarily the left brain includes writing, book-keeping, selling, and laboratory jobs.

The right brain excels in recognizing patterns and shapes and how they relate to one another. It is, for example, probably instrumental in remembering faces. It is the half of the brain that seems to contribute most to insight and imagination and that appreciates the arts and understands humour. The work of an architect would draw heavily on the right hemisphere, as would that of a musician or gardener.



Although it doesn't initiate speech, the right hemisphere apparently has a role in creating and perceiving the emotional nuances of speech. Take, for instance, the remark: "You're unbelievable!" It can be critical or admiring, depending on how it is said. One man with stroke damage in the right brain couldn't understand the intonation. Another man with right-brain damage, though he could say "you're unbelievable," might only say it in a monotone.

Is one hemisphere dominant?

In 1861 Paul Broca, a French physician, observed that damage to the left side of the brain was associated with loss of speech. This discovery led, in time, to the conclusion that the left hemisphere controls speech.

Because damage to the right half of the brain seemed to produce no comparable deficit, the right hemisphere was thought to be less important for human success. The left half of the brain came to be called the dominant hemisphere and the right half was then termed the minor hemisphere. Subsequent research has shown the role of the right hemisphere in perceiving spatial relationships and in many kinds of creativity. In fact, so much attention has been given socalled "right-brain thinking" in recent years that some people believe that the right hemisphere, not the left, is the dominant one. Probably the middle ground is closest to the truth: both hemispheres, working together, are important.

Does each lobe have a special function?

In the last 20 or 30 years, the idea that each lobe has specific tasks has undergone revision as neuroscientists probed deeper into the secrets of the brain. Although the lobes do specialize in certain functions, there is more and more evidence that many important responsibilities are shared by more than one lobe. Thus, it is wise to remember that certain functions are primarily, not exclusively, the business of one lobe or another.

The frontal lobes, just behind and above the eyes, include the motor cortex at the rear of each lobe, a control centre for body movements. The left frontal lobe plays a key role in speech. The prefrontal (nearest the front) part of the lobes seems to have much to do with the interaction of thought, emotions, and behaviour.

The temporal lobes, named for their location at the temples, are involved in hearing and memory. if one temporal lobe is damaged, hearing is not lost, since nerves from both ears go to each temporal lobe. Through links with the limbic system, the temporal lobes seem to affect how we experience fear, anger, lust, and jealousy.

The parietal (from Latin paries, "wall") lobes are named after the bones that form the back top half and sides of the skull. These lobes are just to the rear of the frontal lobes, and the frontmost portion of the parietal

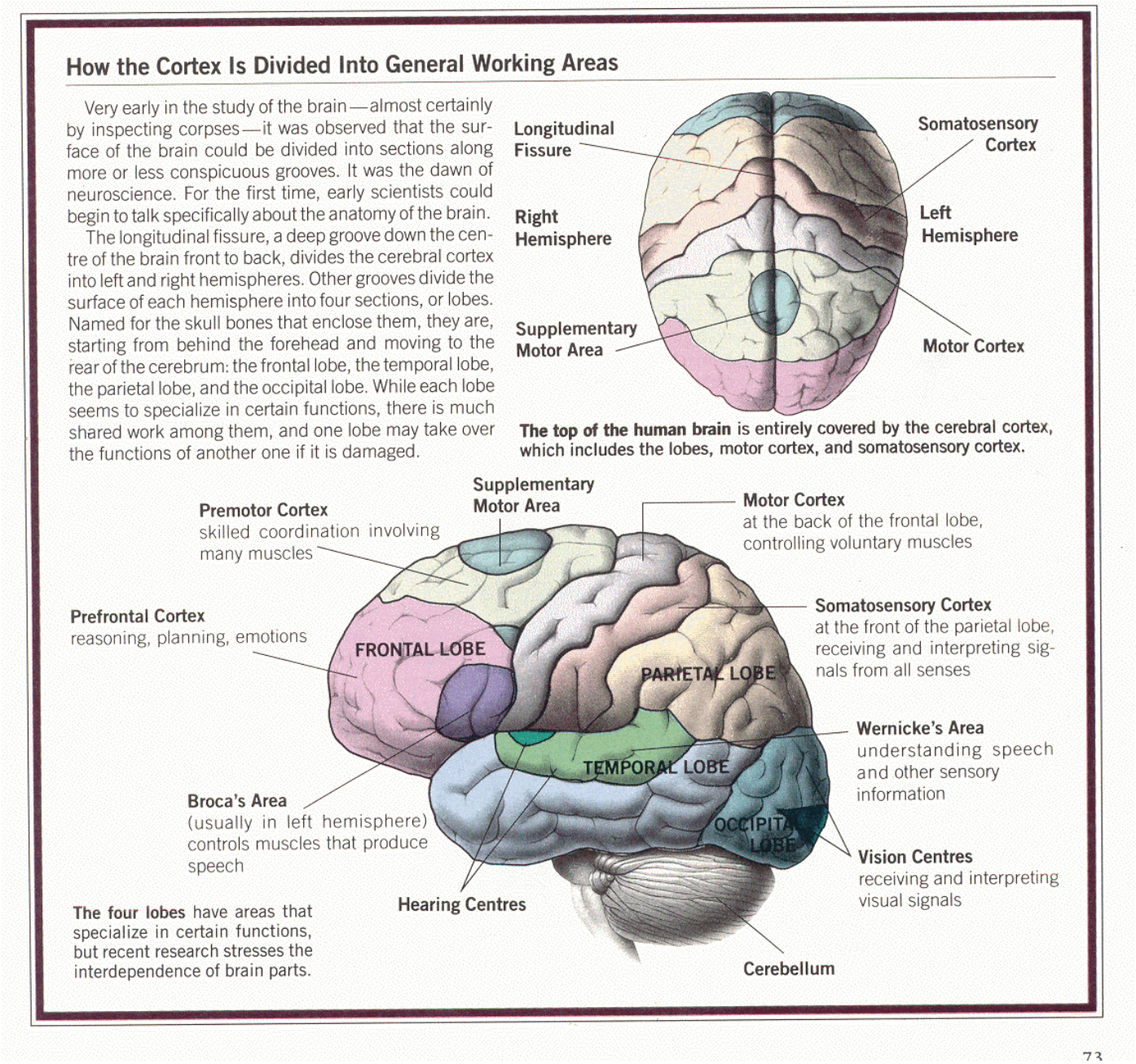
lobe is the somatosensory cortex. It is directly across a groove from the motor cortex, the rearmost portion of the frontal lobes. The somatosensory cortex is a receiving area for sensations.
The occipital lobes, beneath the occipital bone that forms most of the lower back and base of the skull, are the smallest lobes, but no less important than the others. Among other functions, they are centres for vision.

How do the lobes work together?

About 12 years after the Frenchman Paul Broca identified a piece of the left frontal lobe as a centre for producing speech, a German neurologist, Karl Wernicke, discovered an area on the left temporal lobe, not far from Broca's area, that was a centre for understanding speech. The interdependence of lobe functions is beautifully demonstrated by the shared work of Broca's and Wernicke's areas in enabling us to repeat aloud a word that we have just heard spoken.
From the ears the sensation of a

heard word travels by neurons to the auditory (or hearing) cortex on the temporal lobe. The word is not understood until it passes through Wernicke's area, also on the temporal lobe, where it is processed so that we recognize it in auditory form. Then it goes to Broca's area, on the frontal lobe, which sends instructions to

the motor cortex, at the rear of the frontal lobe, to drive the muscles of your lips, tongue, and larynx to utter the word.



Where are the speech centres?

For 70 percent of left-handers, the left hemisphere controls speech, just as it does in all but a few righthanders. But for 15 percent of lefthanded persons, the right half of the brain controls speech. For the remaining 15 percent, speech is controlled by both right and left hemispheres.

Interestingly, stuttering may be more common among left-handed males. One theory on a cause of stuttering is that in some left-handed persons, the two hemispheres of the brain compete for control of speech.

Autism may also be linked to variations from normal patterns of speech control by the hemispheres. It appears that a majority of autistic children are left-handed, and childhood autism is characterized by speech

difficulties that vary from muteness, to delayed onset of speech, to strange speaking patterns. Yet autistic children often show considerable artistic or musical abilities.

What happens when the frontal lobes are injured?

In 1848 Phineas Gage was blasting rock in a Vermont gorge when he accidentally sparked an explosion that sent a 3½-foot iron rod ripping through his head. It apparently destroyed most of his left frontal lobe.

Miraculously, Gage not only survived but went on to make a full physical recovery. But his personality underwent a dramatic change. Before the accident, Gage was, in the words of his physician, “shrewd, smart, . . . very energetic and persistent in executing all his plans." Afterwards, he was “fitful, irreverent ... impatient of restraint or advice when it conflicts with his desires.” He constantly changed his plans and had become “a child in his intellectual capacity." He was reduced to working as a stable hand and, for a while, as a sideshow freak for P. T. Barnum.

As with Gage, damage to the frontal lobes always produces a change in the way a person feels and expresses emotion. But the exact effect on the person's behaviour varies from erratic activity to emotional flatness. The full consequence of damage to the frontal lobes, wrote the psychologist A. R. Luria, “still remains the most baffling section of psychoneurology."

In the 1940's and 1950's, surgery on the frontal lobes, an operation called prefrontal lobotomy, was done on many patients who were extremely agitated or violent. Although the procedure calmed the patients, it has been all but abandoned because it rendered the patients irreversibly and profoundly apathetic.

The brain maps *of phrenologists were incorrect, but they were on the right track; many brain functions* are *localized.*

What is meant by the neglect syndrome?

Some people who have suffered a stroke or extensive damage to the right rear of the head may behave as if the left side of everything, including their own body, does not exist. This is called the neglect syndrome.

Males with neglect syndrome shave just the right sides of their faces, and women apply makeup only to the right side. Their neglect of the left leads them to eat food only on the right side of a plate and complete only the right side of drawings.

People with this kind of damage in the right hemisphere may deny that the left sides of their bodies exist. Oddly, patients with similar damage in the left hemisphere seldom show the neglect syndrome.

The reasons for the neglect syndrome are not yet clear. Many neglect patients are blind in their left visual fields. That is, they can't see anything to the left of the point on which they are focusing. It may be that the mechanisms that control selective attention are in the right hemisphere. Another possibility is that the left hemisphere cannot compensate when the right hemisphere's abilities to grasp spatial relationships are lost.

Why isn't the face familiar?

In the title essay of his book *The Man Who Mistook His Wife for a Hat*, the neurologist Oliver Sacks describes a man, called Dr. P., who suffers from prosopagnosia, the inability to recognize faces. The man's vision, intelligence, and memory were not affected, but he had lost the ability to associate names with faces, to link features with identity.

Dr. P.'s problem was traced to a tumour or degeneration that affected how his brain processed visual information. It is likely that the damage involved the occipital lobes of both hemispheres. Possibly these lobes do more than simply register stimuli. They could also play a part in matching incoming visual signals against images and patterns stored in memory.

What is the source of *déjà vu*?

Déjà vu, the feeling that something you are seeing or experiencing for the first time is something you have seen or experienced before, may arise from electrochemical events in the temporal lobes. Not only does the sensation often follow injury to the temporal lobes, but also it is commonly experienced by people with temporal lobe epilepsy. Moreover, neuroscientists have produced sensations of *déjà vu* by giving minute electric shocks to those lobes