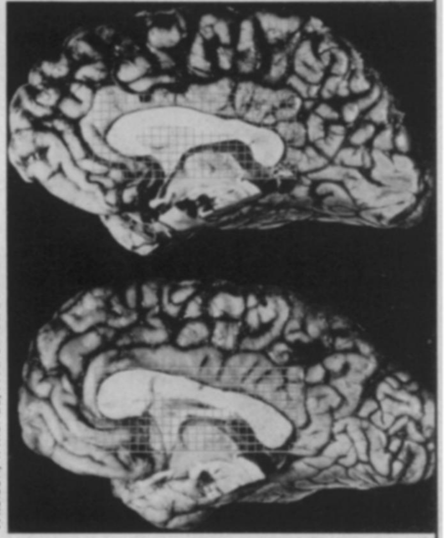
Right-handers' reduced brain connection

A psychologist at McMaster University in Hamilton, Ontario, has uncovered what appears to be a fundamental difference between the brains of right-handers and those of left- and mixed-handers. The corpus callosum—a thicket of nerve fibers that joins the right and left brain hemispheres and permits the two sides of the brain to communicate with each other — is about 11 percent larger in left-handed and ambidextrous people, reports Sandra F. Witelson in the Aug. 16 SCIENCE.



Witelson, T. Monus, P. Knowles/SCIENCE

The corpus callosum —outlined by a grid —of an ambidextrous female (below) is larger than that of a right-handed female (above).

The finding does not demonstrate that these people have a built-in advantage over right-handers in thinking or information processing, cautions Witelson. It does imply, however, that left-handers are not "mirror images" of right-handers. "There is an actual anatomical difference in at least one brain structure," she says. "A bigger corpus callosum may have more nerve fibers. This would mean there are more connections in the brain and more possibilities for [hemispheric] intercommunication."

Previous studies, using mainly right-handers, have indicated that language and analytic functions are controlled largely by the left side of the brain, while spatial and nonverbal processes are coordinated primarily by the right side. But nonright-handers, says Witelson, may have a more even distribution of language and spatial functions that calls for more side-to-side communication along a larger corpus callosum.

This is the first time, she adds, that postmortem examinations of individuals' corpus callosa have been compared with neuropsychological tests administered while they were alive. Her sample was composed of 42 seriously ill cancer patients who agreed to undergo tests and, in the event of death, to donate their brains to the scientific endeavor. They ranged in age from 25 to 65 years at the time of death. Consistent right-handedness was found in 27 subjects, and 15 showed mixed-handedness, using combinations of left- and right-hand preference for various tasks. Consistent left-hand preference is rare, says Witelson, and was not observed in any of the subjects.

Although the mixed-handers were found to have a larger corpus callosum than consistent right-handers by about 11 percent, no size difference was found for a small section at the rear of the fiber bundle known as the splenium. There is evidence, notes Witelson, that the splenium largely transmits messages about sensory stimuli; the rest of the corpus callosum may be involved in higher-level processes that vary according to handedness.

The sex of the person, she points out, made no difference in the size of the corpus callosum.

Witelson and her co-workers are now attempting to determine whether the larger corpus callosa of mixed-handers contain a greater total number of nerve fibers, thicker axons (which transmit messages from neurons), more myelin (which coats the axons) or thicker fibers.

If more fibers do exist in the larger callosa of mixed-handers, says Witelson, the difference between hand groups may be related in part to neuron death that occurs during gestation. Recent studies indicate that there is an overproduction of brain cells in the developing fetus, she explains. By about 7 months after conception, neurons and their connecting axons are reduced as brain structure is fine-tuned. In this scenario, the 70 percent of the population that is right-handed undergoes markedly more neuronal death before birth than the mixed- and left-handed minority.

"The more fruitful question may be not what leads to more fibers in nonright-handers," observes Witelson, "but what results in fewer fibers in consistent right-handers." Everyone may start out ambidextrous, she says, but for some reason most people develop a specialization of functions in the brain hemispheres that is associated with right-handedness.

It is not known, however, whether verbal skills and other intellectual abilities are superior when localized in one brain hemisphere or shared by both hemispheres, adds Witelson.

"With this basic finding," she says, "researchers can expand the data using modern imaging technology to study the brains of living subjects." *—B. Bower*

Breaking the rules in crystallography

Rummaging through rubbish bins, crystallographers are taking a fresh look at crystal structure — dusting off old photographs, retrieving discarded data, remeasuring key parameters. Furthermore, results from recent experiments are adding to the slew of unconventional crystal patterns into which atoms now appear to settle.

This burst of activity was sparked by reports late last year of a crystal pattern that violates some long-established crystallographic rules (SN: 1/19/85, p. 37; 3/23/85, p. 188). These crystals, usually aluminum alloys containing small amounts of manganese, iron or chromium, seem to have an icosahedral crystal structure, which shows a fivefold symmetry. Blocks of atoms in such an arrangement can't be piled in a regularly repeating pattern.

In the July 29 PHYSICAL REVIEW LETTERS, a team of Japanese scientists adds a nickel-chromium alloy to the list of substances that may have an unusual crystal form. In electron diffraction patterns, tiny particles of this alloy show a 12-fold symmetry. The researchers suggest that the nickel and chromium atoms are arranged in a network of incomplete 12-sided figures (dodecagons) resulting in a "crystalloid" state that falls somewhere between the orderliness of a regular crystal and the completely disordered amorphous state.

"It's certainly quite exciting to see something noncrystallographic in an alloy that isn't aluminum-based," says physicist David R. Nelson of Harvard University. But much more work must be done to confirm the Japanese results and to see how their structure fits into the rapidly evolving theory of nonperiodic crystals.

At AT&T Bell Laboratories in Murray Hill, N.J., researchers are reexamining puzzling data taken as long as 40 years ago from very complex diffraction patterns. The patterns imply that this particular crystal, an aluminum-manganese-silicon alloy, may have thousands of atoms in its "unit cells," the building blocks that make up the complete crystal. Now, the investigators suspect that each unit cell may contain atoms arranged in the form of icosahedra. But on a large scale, the blocks form a conventional crystal pattern.

An Indian scientist recently found a similar combination of structures in a magnesium-zinc-aluminum alloy. This led to the production by rapid cooling of the first icosahedral crystals made from an alloy that is not largely aluminum.

Equally intriguing is a newly created hybrid crystal structure that consists of sheets of atoms arranged so that they show a 10-fold symmetry within a layer — yet the layers can be stacked to form a periodic crystal lattice. *—I. Peterson*