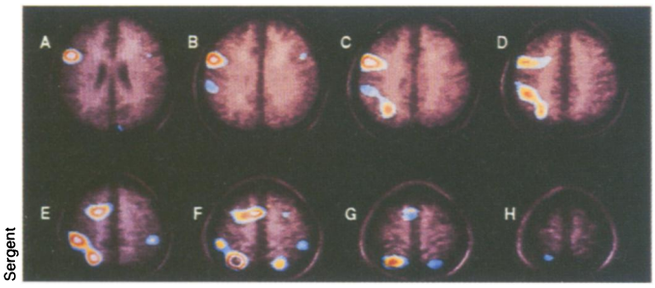
Going with the flow of musical brains



Sergent

Horizontal brain images show areas of greatest average blood flow for all 10 volunteers during sight-reading and piano performance.

Some musicians afflicted with extensive brain damage experience a tragic loss of both verbal and musical skills. In one poignant case, French composer Maurice Ravel developed a progressive brain disease of unknown origin that first robbed him of the ability to write and to perform many basic motor skills. Ravel then lost the capacity to read and play music, as well as his formidable gift for composition. Yet he could still play scales on the piano, and until his death in 1937, he derived the same joy as always from listening to music.

Scientists who use imaging technology to study the brains of performing musicians now offer a likely reason for Ravel's particular lapses, as well as the first solid clues to the regions of the brain involved in musical performance.

When an accomplished pianist reads musical notation and plays the composition on a keyboard, a network of areas throughout the brain springs into action, report psychologist Justine Sergent of McGill University in Montreal and her colleagues in the July 3 SCIENCE. These brain structures perform functions distinct from the duties of the far-flung cerebral regions crucial for language (SN: 4/30/88, p.280), but the two brain systems lie adjacent to one another. Thus, widespread brain damage often blocks various language and musical skills, as in Ravel's case, the Canadian researchers assert.

Sergent's group recruited 10 right-handed, classical pianists, each with at least 15 years of musical training. The scientists mapped blood-flow increases in the brain, which indicate greater brain activity, by injecting each participant with water containing a minute amount of a radioactively labeled oxygen compound. A positron emission tomography (PET) scanner measured gamma rays emitted by the rapidly decaying radioactive marker.

PET imaging lasted for one minute while volunteers reclined and read a musical score for the right hand, displayed on a television monitor. Another one-minute PET session took place while they played the same score on a small electronic keyboard within easy reach.

The researchers isolated areas involved in the two musical tasks by removing PET data on blood-flow activity generated during control trials involving visual fixation on a blank screen, manual responses to dots shown on the screen, and listening to and playing musical scales.

Sergent's group superimposed PET images over magnetic resonance imaging (MRI) views of volunteers' brains to pinpoint areas of greatest blood flow. The results indicate that sight-reading and piano performance activate parts of all four lobes of the brain's outer layer, or cortex, and the cerebellum, which sits at the base of the cortex. Many brain areas involved in word processing brush against cerebral nodes in the musical network, although musical performance also activates areas that handle the spatial information embodied in notes on a musical staff, according to Sergent.

"Sight-reading and piano playing with the right hand are only a fraction of musical experience, and we are still far from understanding the pleasure and emotions elicited by music, as well as the composer's mind," Sergent says.

– B. Bower

Killer-cell infusions fight viral diseases

Infusions of white blood cells called killer T cells can arm bone marrow transplant recipients against a virus that often causes deadly lung infections among such patients, according to the results of a new study.

Researchers speculate that the treatment might also benefit AIDS patients, who are vulnerable to infection with the same virus. A similar strategy, they suggest, might also help AIDS patients combat HIV, the virus that causes AIDS.

The treatment consists of taking uninfected killer T cells from the blood of healthy people who have been exposed to a particular virus and inserting those cells into a sick person infected with the same virus. The previous exposure primes the killer cells to attack and eradicate the patient's infected cells. Otherwise, such infected cells could serve as founts of continuing infection.

In the new study, a group of researchers at the Fred Hutchinson Cancer Research Center in Seattle infused killer T cells isolated from bone marrow donors exposed to cytomegalovirus (CMV) into three cancer patients who had received bone marrow transplants as part of their treatment. The group, led by immunologist Stanley R. Riddell, hoped that the killer cells would prevent the transplant recipients from succumbing to a CMV infection while their own immune systems were recovering.

CMV only causes illness in people with impaired immune systems. Bone marrow transplant recipients – as well as patients who receive whole-organ transplants – are at risk because they must take immunity-suppressing drugs to avoid rejecting their new grafts. Even a month after transplantation, two-thirds of all bone marrow recipients lack sufficient T cells to ward off CMV infection, according to previous studies. And despite treatment with the antiviral drug ganciclovir, half of all bone marrow transplant recipients who develop a CMV infection die, usually of CMV pneumonia.

CMV's effects in AIDS patients are similarly grim. While few AIDS patients develop CMV pneumonia, most carry a CMV infection, which can contribute to weight loss and wasting. Roughly 20 percent of all AIDS patients also develop CMV retinitis, an infection of the retina that can progress to blindness (SN: 10/26/91, p.260).

To test their new anti-CMV preventive, Riddell's group administered four weekly doses of roughly 2 billion CMV-exposed killer T cells to each of the three bone marrow recipients. The researchers selected only those cells that were incapable of attacking the recipients' own cells and causing graft-vs.-host disease.

Riddell and his colleagues report in the July 10 SCIENCE that the cell infusions boosted the bone marrow transplant recipients' ability to kill CMV-infected cells. In test-tube experiments, they found that blood from the recipients could kill just as many, if not more, CMV-infected cells as blood from the marrow donors. Moreover, none of the recipients fell ill from a CMV infection or developed side effects from the treatment.

Riddell says his group plans to confirm the efficacy of the treatment in a larger number of bone marrow transplant recipients. In addition, they are preparing to treat their first AIDS patient with HIV-exposed killer T cells "within a couple of months." Riddell and his colleagues also plan to infuse AIDS patients with CMV-exposed killer T cells to help them ward off CMV infection.

The success of Riddell's group in preventing CMV infection among bone marrow transplant recipients "is certainly going to have a positive impact on the efforts to use HIV-specific [killer T cells] in HIV-infected individuals," says Anthony S. Fauci, director of the National Institute of Allergy and Infectious Diseases in Bethesda, Md. "This is an interesting and important step in the right direction."

– C. Ezzell