Hepatitis C test shows promise, pitfalls

An experimental blood test that detects antibodies to hepatitis C in donated blood identifies many, but not all, tainted units, two studies indicate. The data suggest that the test, now under consideration by the Food and Drug Administration for routine use in blood banks, will reduce the number of transfusion-associated cases of hepatitis C. But the test's inability to flag all infectious units hints at the presence of an undiscovered causative agent underlying some hepatitis cases, and highlights the difficulties of eliminating the potentially fatal liver disease.

Viral hepatitis remains the most common complication associated with U.S. blood transfusions. About 90 percent of such cases show no evidence of the viruses responsible for hepatitis A or B; most probably result from hepatitis C virus, first identified in 1988. With no hepatitis C screen yet licensed by the FDA, most U.S. blood banks screen for hepatitis A and B antibodies and for indirect evidence of the C virus, such as elevated levels of a liver enzyme.

Cladd E. Stevens and Patricia E. Taylor of the New York Blood Center and their colleagues tested serum samples saved from 456 individuals who donated blood in 1985 and 1986. They report in the Jan. 5 JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION that indirect tests alone would not have identified one-third to one-half of their hepatitis-C-tainted blood units, suggesting the test "should contribute significantly" to reducing the risk of hepatitis C in transfusion recipients.

But a second study reported in the same issue suggests the indirect tests may remain useful even after approval of a hepatitis C screen. James W. Mosley of the University of Southern California School of Medicine in Los Angeles and his colleagues looked at serum saved from 24 transfusion recipients from the 1970s. They found hepatitis C antibodies in only six of 10 recipients who developed non-A, non-B hepatitis. They conclude that the experimental test may be "less than optimal" or that another virus or nonviral agent may cause a significant number of non-A, non-B hepatitis cases.

Researchers remain hampered by their poor understanding of hepatitis C's epidemiology and of how the virus interacts with the immune system. For example, while older donors as a group show a decreased prevalence of hepatitis C antibodies, scientists don't know whether this reflects an age-related loss of antibody, a higher mortality from liver disease in this group, or some other factor. The relationships among elevated liver enzyme levels, persistence of hepatitis C antibodies and actual infectiousness of donated blood also remain unclear.

– R. Weiss

Chip mimics hearing

Confirming a 40-year-old theory of how the brain perceives pitch, two scientists have built a computer chip that duplicates the human ability to "hear" a fundamental note missing from a harmony.

The analog chip, which contains 125,000 transistors arranged in patterns that follow known structures in the brain, analyzes a "sound wave" – actually a varying electrical signal – as fast as a human ear can, report John Lazzaro and Carver Mead of the California Institute of Technology in Pasadena. They describe the device in the December PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (Vol.86, No.23).

The chip splits a complex signal into 62 sine waves, each sent to a processor that delays the wave and compares its signal with that of an undelayed wave. If the two signals line up, a "correlation neuron" fires. And if all the frequencies in the input signal are multiples of a missing fundamental frequency, the circuit's output conveys only the missing element.

Although the chips require a great deal of expertise to build, they provide a powerful tool for testing theories about the nervous system, says vision researcher Terrence J. Sejnowski of the Salk Institute for Biological Studies in La Jolla, Calif. "It's a harbinger of the types of models that we need to develop," he says.

Sejnowski predicts, however, that "it's going to be a while before experimental biologists will be able to fully appreciate the power of this particular technique, because it's so far removed from the techniques they're familiar with."

– A. McKenzie

Putting a far finer point on visible light

By repackaging light as molecular disturbances known as excitons, researchers have accomplished the equivalent of passing a camel through the eye of a needle. In this remarkable scheme for "slimming down" light to get it through a tiny opening, an incoming beam strikes a microscopic crystal wedged in the narrow end of a tapered, open-ended tube to generate excitons. The light-generated excitons, effectively only one-billionth the volume of the corresponding light beam, roam through the crystal, readily passing through the narrow aperture, and then decay into visible light.

"It's very hard to force light through a very small opening," says chemist Raoul Kopelman of the University of Michigan in Ann Arbor. "Photons don't want to go through, but if you repackage the light as excitons, it has no problem getting through."

By channeling the incoming light's energy in this way, the crystal in effect acts as a tiny light source much smaller than the light's wavelength. Such a source may permit researchers to develop improved visible-light microscopes that would have the same high resolution as electron microscopes but likely would do much less damage to delicate biological samples. Exciton light sources may also prove useful for molecular sensing and as inexpensive alternatives to light-emitting diodes and diode lasers in optical integrated circuits.

Kopelman and his colleagues at Hebrew University in Jerusalem grow tiny crystals of anthracene at the tips of metal-coated glass micropipettes. The tips' inner diameters measure 100 nanometers or less. Intense ultraviolet light from an argon ion laser, directed through the pipette, illuminates the anthracene crystal, generating excitons that diffuse through the material. These excitons, which transport energy on a molecular or atomic scale, collect at certain spots on the anthracene crystal's surface, where they combine and decay into blue light. That light emerges from a point no larger than the crystal itself.

"With this approach, energy can be guided directly to the aperture at the pipette tip instead of being allowed to propagate freely in the form of an electromagnetic wave. . . ," the researchers report in the Jan. 5 SCIENCE. Energy-confining materials such as anthracene "allow light to be effectively transmitted through the 'bottleneck' created by the subwavelength dimensions of the tip near the aperture."

Such a transport process is also reminiscent of a key stage in photosynthesis. "Green plants have learned the same trick of collecting light over a large area and then channeling it to a very small place," Kopelman says.

He and his colleagues are now studying ways of using their light source for "near-field" optical microscopy. The idea is to bring a sample so close to the microscope that light emerging from an aperture doesn't have enough room to spread out into the wavelength-dependent diffraction pattern that normally limits a microscope's resolution. In near-field imaging, because the size and shape of the aperture rather than the wavelength determine the resolution, the new light source provides a solution to the problem of getting enough light through a sufficiently small aperture to create a clear image.

– I. Peterson