Blood-Brain Barrier

Given the choice, most would rather receive medicine through an injection in the blood stream over a hole drilled in the skull. Unfortunately, many of the new therapies developed for brain ailments cannot be administered through the blood because they are barred from crossing into the brain. Fortunately, investigations of the mechanisms of this blocking system are helping researchers perfect techniques that manipulate the system and transport therapeutic agents from the body’s blood supply directly to the brain.

The blood-brain barrier prevents many low-life forms, such as toxins, that make it into the blood stream from tainting the brain’s pristine nerve cell habitat.

Sometimes, however, appearances are deceiving.

A number of therapeutic agents that might be beneficial are barred from the brain. Now research is helping to get these compounds special admission.

Investigations focus on techniques that either storm the brain’s gates or camouflage therapies by attaching them to molecules that already have brain access. The new research on this brain crashing is leading to:

- Improved treatment of brain ailments.
- A better understanding of the biology behind the brain’s protective barrier.

In the early 1900s researchers found the first evidence that the brain had a specialized barrier that protected its cells. Dyes injected into the body’s blood supply would stain the tissues of most organs - but not the brain. It’s now known that a "blood-brain barrier" keeps many substances out of the brain. The walls of the vessels that carry blood into the brain form the barrier. Leaky blood vessels in the body allow many molecules to cross through to tissue, but the tight construction of the vessels in the head guards against brain entry. Who makes the brain’s "A list?" Blood gases such as oxygen and small nutritional molecules are the main outsiders that can make it in.

Accumulating research on animals and humans is helping researchers place important therapeutic agents on the list as well. Some new techniques latch agents onto molecules
that already have brain access. In one method, researchers attach therapies to the natural molecule docosahexaenoic acid (DHA). Some evidence suggests that the transport technique can carry a variety of molecules from the blood to the brain in animal models, which could benefit a number of brain diseases. For example, they combined DHA with proteins that are suspected to protect nerve cells from the damage seen in ailments like stroke and Alzheimer's disease. Nerve cells were protected in rat models of stroke, according to preliminary data.

Other researchers found that another molecular combination technique transported therapies, including nerve cell-protecting molecules, to the brains of animals. This version makes use of a vessel site that the molecule insulin uses to get into the brain. Scientists now are developing a human version of the approach for additional testing.

Another method that holds promise involves opening the blood-brain barrier. In one version, the sugar mannitol causes the cells that line the vessel walls to shrink temporarily allowing a cancer drug to flow past the gates to the brain tissue. More than 450 patients have received this procedure to treat specific cancers in the central nervous system. The method, however, targets the entire central nervous system, which may be better for cancers not confined to specific areas.

Other researchers are testing a compound in humans that selectively opens the barrier only near cancer-laden brain areas. The researchers hope that the compound will allow therapies to kill off the localized cancer while not exposing the healthy brain areas to potentially harmful drugs.

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