

Breaching barriers

Reaching remedies

In her first few years at Cornell, Dr. Margaret Bynoe rocked the world of immunology with major advances that are already changing how diseases are treated.

Some were so unconventional that it took time to convince her peers they could work. "I've been told things couldn't be done," said Dr. Bynoe, "and that I was only 'challenging dogma.' But that's how science builds knowledge."

Dr. Bynoe knew she was on to something when she developed a novel treatment for multiple sclerosis (MS) in mice, an auto-immune disease that affects the nervous system.

"The immune system is like a child," she said. "It learns as it matures. If it learns improperly it starts attacking the body. In MS it targets myelin, the protective coating insulating nerves. To stop this we need a way to re-educate an adult immune system."

Dr. Bynoe created patches soaked in myelin, applying them to the skin of mice genetically predisposed to MS. "Their immune systems learned to recognize myelin as friend, not foe. We successfully abolished the disease."

When she submitted a grant to develop this technique into a human treatment, reviewers said it would never work. Several years later, Dr. Bynoe's work inspired a group of Polish researchers to use her technique on humans, significantly reducing symptoms in 80 percent of MS patients in their trial.

The ability to re-imagine paradigms helped Dr. Bynoe discover another new

technique with the potential to shape the course of treatments for MS and other major neurological ailments.

"While investigating Adenosine, a crucial compound in many bodily processes, we discovered that it regulates the blood-brain barrier, which prevents most immune cells and foreign substances from entering the brain," she said.

On the bloodstream highway, the brain is a restricted exit, but sometimes pathogenic particles sneak through its molecular gate.

"Diseases that infiltrate the brain become difficult to treat," Dr. Bynoe said. "If we could regulate the barrier safely we could put a damper on diseases like Alzheimer's, cancer, and HIV-AIDS, by delivering drugs directly to afflicted cells. We could also potentially close the gate to stop rogue immune responses like those that cause MS. Adenosine seems to be the gatekeeper. We think we have the key."

Using caffeine to block Adenosine from opening the gate to immune cells, Dr. Bynoe stopped MS-like symptoms in mice. Her lab's next goal is to use Adenosine to get treatments past the barrier in mice with Alzheimer's. Using various models in collaboration with other scientists, they plan to investigate barrier-breaching treatments that could one day tackle HIV-AIDS.

"It took over a year of rigorous experimentation to confirm it works," said Dr. Bynoe. "Now we hope to expand to treating larger animals."

Partnering with entrepreneurs and investors, Dr. Bynoe helped found a growing company driven by her research. They are currently working to develop tools that will treat a wide array of human neurologic diseases.

Unlocking new treatment potential for major diseases from MS to Alzheimer's to HIV