

# Reducing the Risks of Traumatic Brain Injury

*A UCR researcher sets his sights on developing a way to detect brain swelling before it becomes life threatening.*

By Lisa O'Neill Hill

In January, U.S. Rep. Gabrielle Giffords was shot in the head – and six others were killed – while she was meeting with constituents outside a Tucson supermarket.

Traumatic brain injuries contribute to a third of all injury-related deaths in the United States. While the primary damage occurs at the time of injury, doctors also have to mitigate the secondary disease processes — including brain swelling — that occur after a traumatic brain injury.

UCR Assistant Clinical Professor and neurosurgeon Devin K. Binder and B. Hyle Park, UCR assistant professor of bioengineering, are working together to find solutions.



“What happened in Gabby Gifford’s case was they had to remove part of the skull to account for the swelling and prevent the patient from dying,” Binder said. “We are looking for a way to reduce swelling that might be better than that. One part is the optical diagnosis and the second is treatment by direct water extraction.”

Binder’s lab has also discovered that brain cell swelling probably starts before seizures.

“It’s the Holy Grail if we can generate these optical detection algorithms and integrate that into a seizure-warning device,” he said.

Cerebral edema, an increase in the water content of brain tissue, can be caused by brain injury, stroke, infections and brain tumors. That swelling can lead to pressure that reduces blood flow to the brain, even to the point of death

“Immediately after impact, there is a period where the brain is susceptible to severe swelling,” Binder said. “If we can detect and treat that swelling early, it will provide a better outcome and fewer brain cells will die.”

The researchers are applying an optical imaging technique — optical coherence tomography — to neuroscience to detect swelling in the brain. As the brain swells, it becomes more transparent to infrared light. By shining light on the surface of the brain and analyzing the amount of reflected light, doctors can see how much swelling has occurred. Their work

represents the first time optical coherence tomography (OCT) has been applied to the brain for diagnostic purposes.

Recently, Binder and Park were awarded a UC Discovery Grant to continue their work.

In associated research, Binder and Victor G. J. Rodgers, UCR professor of bioengineering, are working on a treatment to remove water from the brain. Rodgers' lab has developed an osmotic water extraction device.

"You open a little window over the brain and the device gently sucks out water. It's a gel with some hollow fibers in it. It pulls the water out. Think of it as controlled dehydration," Binder said. "The standard treatment has been to give drugs. Sometimes that works, but very often it doesn't."

Their work could have broad implications not only for shooting victims like Giffords, but for veterans and anyone with traumatic brain injuries.

Find out more at

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